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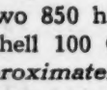

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SHELL 100 OCTANE *AVIATION* GASOLINE

By Capt. Rudolph Jahn
Deutsche Lufthansa

Deutschland über dem Nord Atlantik

GERMANY'S interest in trans-Atlantic flying which culminated in the survey flights of the two Dornier flying boats *Zephir* and *Aeolus* late this summer dates back many years. In 1929 Deutsche Lufthansa A.G. inaugurated a ship to shore service for mail in conjunction with the North German Lloyd line ships *Bremen* and *Europa*. No trans-Atlantic service was undertaken at that time, but the plan was to save on mail schedules by catapulting planes from the steamers when about 600 miles off the coast when approaching the United States or Great Britain. Single-engined twin-float Junkers seaplanes with a crew of two pilots were used. The average saving in time amounted to about 50 hours on mail deliveries. Accelerated mail service of this type was carried on regularly for eight years during the summer months only.

The experience with the mail service proved so satisfactory, and so much was learned about catapulting that when flight operations across the South Atlantic were being studied, the use of a catapult for launching the larger flying boats was considered the most practical device to adopt. The Heinkel Works (who had done much of the early work with catapults) designed equipment suitable for launching flying boats up to a total gross weight of 15 tons.

After exhaustive tests ashore it was decided to install the equipment on board a ship. A small freighter, the *Westphalen,* was secured and her upper works rebuilt to accommodate a catapult forward (of the same type to be described later for the *Schwabenland*) and a crane for hoisting flying boats aboard was installed aft. Most novel part of the equipment was a large canvas apron which could be trailed astern and which made available a sort of ramp onto which flying boats could be taxied before being hoisted on board. Without the apron it would be impractical to try to secure the boat to the crane in any sort of sea. The apron established a reasonably fixed relationship between the crane and the flying boat and enabled it to be taken on board without damage.

In those days the range of the Dornier Wals which were being used for the service was not great enough to fly the whole stretch across the South Atlantic, and the *Westphalen* was stationed halfway between Bathurst in

AVIATION

The Zephir ready for launching from the Schwabenland's catapult at Port Washington, N. Y., on Sept. 22, 1936.

AVIATION

Looking along the Schwabenland's decks showing the Aeolus secured on the track before being swung onto the catapult.

AVIATION

Details of the catapult carriage. In this case the carriage is not on the catapult but on the spare track. The ship is the "Aeolus."

West Africa and Natal in Brazil. The procedure was to land the flying boat alongside, take it on board, refuel it and catapult off to resume its flight.

With the advent of the so-called 10-ton Wal the range was so increased that the crossing could be made without intermediate landing. The *Westphalen* was accordingly withdrawn from mid-Atlantic and a newer catapult ship, the *Schwabenland,* was acquired. By stationing one ship on one side of the Atlantic and one on the other it was possible to catapult the 10-ton Wal into the air with sufficient fuel for the crossing. The time, which under the older system was five to six days from Berlin to Natal, was thus speeded up to an average of three days. Actually, at the present time the schedules are running close to 2½ days.

When the North Atlantic services were studied, it was decided to use a similar arrangement, but the range of the 10-ton Wal was not sufficient to cover the longest over-water jump. A new machine had to be designed for this work which is now known as the Do-18. The *Zephir* and the *Aeolus* are of this type.

Although the Do-18 traces its ancestry back to the original Dornier Wal which carried Amundsen over the North Pole, the new model shows many aerodynamic and structural refinements. It was not intended for passenger service but for carrying mail and freight over long ranges after catapulting. The ship is a high-wing monoplane of all metal construction, stabilized on the water by sea wings of the type familiar to American readers on the Martin Model 130 Clipper. The wings are semi-cantilevered, strut braced to the sea wings. Between the hull and the wing is a streamlined turret through which the crew can reach the interior of the engine nacelles.

The wing is very efficient both structurally and aerodynamically. It is tapered in thickness and in plan form, with the thickest portion at the points where the bracing struts are connected. Each panel tapers both toward the center section and toward the tips. The wing carries a flap below the trailing edge which runs practically the full length of the span (except across the center section). Each auxiliary wing is divided into two sections, the

inner of which function only as a flap, the outer section functioning both as flap and as aileron.

The hull is divided into a number of compartments fore and aft. In the extreme nose is housed all the marine equipment including anchors, tow-lines, etc. Next comes the pilot's cockpit. Particular attention has been paid to visibility for both pilots. The transparent cockpit covers are hinged to provide entrance to the compartment. The instrument board is fitted with all the necessary navigation and engine control instruments. Its layout is simple and efficient. Dual controls are fitted.

Immediately behind the pilot's cockpit, accessible through a door in the bulkhead, is the radio and navigation room. Equipment for two-way communication on long and short waves is installed. Radio direction-finding equipment is also on board. As may be seen in some of the photographs, a rotatable loop antenna is mounted well toward the tail, remote controlled from the operator's position. On the port side, opposite the radio operator is the navigator's table with convenient map cases, instruments, etc.

Behind the navigating room is a compartment which holds miscellaneous mechanical equipment including an oil tank, an emergency fuel pump, storage batteries, cooling water storage tank, bilge pumps, etc. A small work bench with hand tools for emergency repairs is also installed. Next aft is a battery of four aluminum fuel tanks having a capacity of about 700 litres (185 gallons), each. These tanks are removable through a screw-down hatch on the deck. Fuel feeding from the four tanks is pumped into a collecting tank and from there to each of the two engines. Immediately behind the fuel section is a compartment for mail and freight. The extreme after part of the hull is empty in flight. It is accessible for inspection through a door in the rear bulkhead.

The two Junkers Jumo 5 diesel engines are installed in tandem in a well faired nacelle which forms the center section of the wing. The cowlings are easily removable, however, so that the engines are completely accessible for maintenance work. The fairing panels along the side of the front engine are hinged and may be let down to serve as platforms on which mechanics may stand. The front engine drives a tractor propeller while the rear one drives a pusher through an extended shaft.

Close-up of the apron in storage showing it in position on its reel.

Baron Karl von Gablenz, technical director of Lufthansa and chief pilot of the Zephir on the first Transatlantic flight.

She's off! A shot of the Zephir just leaving the catapult carriage of the Schwabenland.

Approaching the Schwabenland, showing general arrangement of catapult crane and apparatus for handling the canvas apron.

Three-bladed metal propellers are fitted to both engines. The forward propeller is of the controllable pitch type. The rear propeller is fixed pitch. Two radiators for cooling water are arranged one above the other in the leading edge of the turret. They are fitted with controllable shutters to control the cooling. This arrangement gives good cooling possibilities and at the same time low aerodynamic resistance. Two reservoirs for

(*Turn to page* 49)

Some Practical Aspects of ROCKETEERING

Although rocket travel to the moon or into the outer reaches of interstellar space still belongs properly to writers in the Jules Verne tradition, there is some possibility that heavily loaded airplanes of the near future may be helped off the ground by means of rocket motors. The author was formerly president of Germany's Rocket Society.

By Willy Ley

FEW problems connected with modern aviation are so frequently discussed, so often misunderstood, misinterpreted and misstated as rocket propulsion.

Though the principle of reaction has been applied in certain toys since the days of ancient Greece, and though powder rockets were known and in use for about seven centuries (the oldest certain source is a Chinese chronicle relating to the battle of Kai-Fung-Foo in 1232 A.D.), scientific rocket research is of quite recent origin. Rocketry is still in its infancy.

The first treatises that clearly indicate the theoretical possibility of reaching the limits of our atmosphere by means of rockets were published in 1903 by the Russian scientist Konstantin Edouardovitch Ziolkovsky. In 1919 followed the publication of Dr. Robert H. Goddard's book, "A Method of Reaching Extreme Altitudes" (Smithsonian Misc. Coll. vol. 71, No. 2) and in 1923 Professor Hermann Oberth's "Die Rakete zu den Planetenräumen."

The basic principle of rocket behavior is established by Newton's Third Law of Motion. Translated freely it says: "Reaction is equal but opposite to action, or the actions of two bodies are equal (in power) but in opposite directions." Or, in mathematical symbols, $MV = mv$, where M and m are the masses involved, V and v are the velocities.

The motion of a rocket, therefore, is independent of the presence and/or nature of the surrounding medium. Neither the density nor the presence or absence of air can be of any influence on the fact that a rocket will move. They can only change the flight performance and (possibly) the efficiency. Though this may be mathematically clear it may be difficult for newcomers to the problem of rocket propulsion to visualize. Actual experiments have shown that the rocket *does* move in *vacuo*. The following example may help to make the procedure understood.

Imagine a stick in a space where there is neither air resistance nor gravity to overcome. Imagine further that the stick is divided into two parts by an explosion,—or by the action of springs,—both parts will fly in opposite directions. Assume that both parts are of equal weight (mass), therefore the velocities will be equal. The sum total of velocities being c, each part has the velocity $c/2$. Disregarding one of the two parts, explode the other one into two equal parts with the same force. One part will then have the velocity $c/2$ plus $c/2$ or c while the other part has the velocity $c/2$ minus $c/2$ or zero. The remaining mass after the second explosion will be $\frac{1}{4}$ of the original mass. Thus, in order to give the velocity c to one part of an assumed mass it is necessary to sacrifice $\frac{3}{4}$ of the mass.

Generally speaking, the increase in speed for the remaining mass is c/n, n being the number of explosions. The

loss of mass after each explosion is m_0/n, m_0 being the original mass. The remaining mass is m_0 minus m_0/n.

After n explosions the remaining mass

$$m_1 = \frac{(n-1)^{n v/c}}{n} \cdot m_0$$

The two examples show that more explosions with smaller particles give better results, the optimum will obviously be an infinite number of explosions expelling infinitely small particles. The formula then becomes $\frac{(\infty - 1)^{\infty}}{\infty}$, its result is 0.368 or $1/e$; e being 2.81828,—the base of Napier's "natural" logarithms. Using the factor e we can simplify the formula to

$$m_1 = m_0\left(\frac{1}{e}\right)^{v/c}$$ which can be written

$$m_0 = m_1 . e^{v/c} \quad \text{or}$$

$$v = c.\ \text{lognat}\ m_0/m_1$$

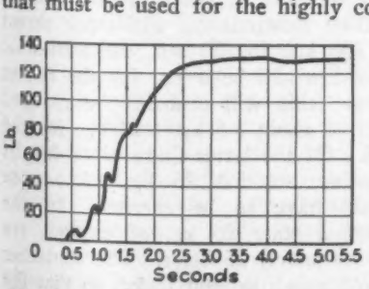
Actually this formula was derived from the differential equation

$$m\,.\,dv + c.dm = 0,$$

which is usually called the "basic formula of rocket propulsion."

In all these formulas v designates the speed of the rocket while c stands for the exhaust speed. It is obvious that c is of greater importance than the loss of mass and generally (if the resistance of the air does not become prohibitive) a fuel with a higher c will be superior to a fuel with a lower c. For this reason scientific rocket experiments have abandoned powder for a fuel completely and now work only with liquid fuels which, in addition to higher exhaust speeds, are easier to handle and to control. Furthermore, there is no liquid fuel that is an explosive in itself. So-called "oxygen-carriers" have to be added to make the fuel combustible. The "oxygen-carrier" is usually pure oxygen which is added to the fuel immediately before combustion.

It is of no consequence whether oxygen is carried in the liquid state or as a gas. Experiments have been carried out both ways, but for rocket *flights* liquid oxygen is the more practical as it does not require the heavy tanks that must be used for the highly compressed gaseous form. It is true that liquid oxygen, because of its extreme low temperature, is not very easy to handle. With a little practical experience, however, it is not more difficult to handle than boiling water.



Thrust diagram of a liquid fuel rocket motor built by the German Rocket Society.

Of the many fuels that were investigated theoretically and tried out experimentally three proved to be very effective and convenient: liquefied methane (CH_4), alcohol and gasoline. Which will be used for a special task depends on other circumstances, for example, on the amount of oxygen that can be carried, and on the available space for the tanks at the disposal of the experimenter. The amount of oxygen necessary to insure complete combustion varies with the fuel, as will be seen from the combustion equations of the three fuels mentioned.

It might be advisable in some cases to select alcohol in spite of its lower calorific content because it needs less oxygen for combustion. In other cases gasoline might be superior in spite of the larger amount of liquid oxygen to be carried. For practical purposes it will scarcely be necessary to use liquid methane, which might be considered only for special scientific work.

Both propellants are placed in separate tanks, usually of aluminum alloys. Normally the oxygen tank must be heat insulated to prevent the liquid oxygen from building up pressure of its own. In special cases rockets have been shot with non-insulated oxygen tanks, utilizing the pressure that automatically develops in the tank to feed the liquid into the rocket motor.

The term "rocket motor" which has been coined by the German experimenters must not be misinterpreted as meaning an internal combustion engine with some kind of rocket action. Actually the term rocket motor designates a device for continuous explosion-like combustion of liquid fuels in the presence of liquid oxygen. A rocket motor consists essentially of only two parts, the combustion chamber and the exhaust nozzle. There are no moving parts in a rocket motor nor in a well constructed rocket.

In order to show how a rocket motor works and how a rocket flight is made it will be best to describe one type of liquid fuel rocket of extremely simple construction that has made several successful flights. The example chosen is one which we designed and built in Germany which we called "Repulsor."

The Repulsor consisted of two long slender tubular tanks of "Elektron," a magnesium alloy of great tensile strength and light weight. Between the two tanks a small rocket motor made of alumium alloy was placed. The tanks were oversized in order to leave room for a surcharge of compressed nitrogen that was to force the fuels into the combustion chamber. The combustion chamber and the nozzle of the rocket motor were surrounded by a water jacket for cooling purposes. The blast of the rocket motor does not spread if the nozzle design is correct, therefore there was no danger of the very hot flame touching the tanks. It housed the parachute and a little clockwork mechanism for releasing the parachute at the right moment near the apex of the flight. In proving stand tests (ground tests where the rocket motor is connected to a device measuring and recording its thrust) it had been found that the parachute container could be placed in the path of the blast for a certain time at a certain distance without being heated unduly.

The assembly of rocket motor, two tanks, parachute container and four fins represented the Repulsor, which was assembled after each part had been tested separately. (Before firing pressure is applied on the tanks amounting to approximately 300 lb. per sq.in.) It was known, mathematically as well as experimentally, how many seconds the rocket motor would burn with the quantity of fuels in the tanks. It was easily computed how many seconds the Repulsor would continue on its upward journey after the rocket motor had ceased firing. The total time (18 sec. in one particular case) was the time that had to elapse between the take off and the expulsion of the parachute. The clockwork started working automatically when the repulsor left its launching cradle. When the calculated time has elapsed the rocket comes about to a standstill and the releasing mechanism ejects the little parachute which brings it safely back to earth.

Since it is impossible to express the power of a rocket motor in ordinary terms it becomes necessary to invent a new type of designation. The thrust of the rocket motor suggested itself for this purpose, but it is insufficient if it stands alone. Therefore the fuel consumption was added according to a key. For example, on the proving stand rocket motors of the type used in the Repulsor flights delivered a thrust of approximately 32 kg. with a fuel consumption of 160 gm. per sec. The designation became therefore "16/32". Since there is a definite relation between fuel consumption, thrust and exhaust velocity ($P = c\ .\ dm/dt$) this designation allows us to calculate the approximate exhaust velocity c.

This type of rocket motor was the smallest built at the proving ground the so-called *Raketenflugplatz*) of the German Rocket Society. The burning time was made to vary between 30 and 90 sec., which is about the time rocket motors have to burn in altitude shots. The next type was called "32/64", and the largest type tested was "1.7/200". Consuming approximately 1.7 kilogram fuel per second it delivered a thrust of approximately 200 kilograms for periods varying between 20 and 25 seconds. These rocket motors made possible the construction of repulsors weighing 120 kg.

The most appropriate application for rocket motors are for altitude rockets to carry instruments into layers of the atmosphere that cannot be reached by other means. Although these so-called "meteorological rockets" may lead to mail-carrying rockets it is doubtful whether rocket motors will ever be able to replace the internal combustion engine for ordinary aircraft. A number of inventors are busy trying to overcome the main obstacle, the low efficiency at low speeds.

The efficiency of a rocket—or rather its overall efficiency—is the product of the "inner" (E_i) and "outer" ($E_{bal.}$) efficiencies, usually called the thermic efficiency (of the rocket motor) and the ballistic efficiency (of the rocket itself).

The "inner" efficiency

$$E_i = \frac{mc^2/2}{mc^2_{theor}/2}\,(c/c_{theor})^2$$

It is under any condition substantially the same for a given rocket motor burning a given amount of given fuels. The "outer" or ballistic efficiency, however, depends mainly upon the velocity of the rocket. Following Dr. Eugen Sänger of Vienna

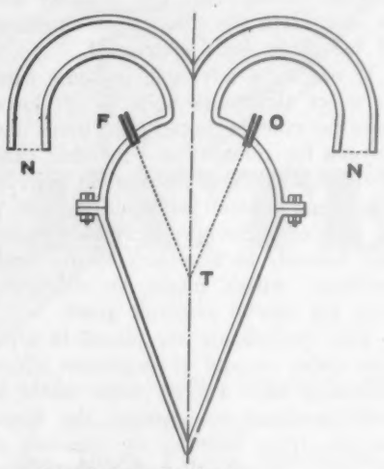
$$E_{bal.} = \frac{mcv}{mc^2/2+mv^2/2}$$

$$E_{bal.} = \frac{2cv}{c^2+v^2}$$

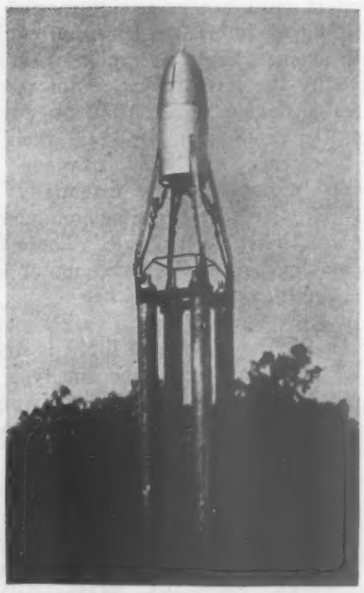
It is disputed whether this formula is valid if $v > c$, but up tc $v = c$ the formula certainly holds good. It is obvious that velocities approaching the exhaust speeds of various fuels (ranging from 1500 in. per sec. to close to 4000 m. per sec.) cannot be expected except in vertical rocket flights.

A special case exists, however, which offers conditions under which a short and powerful push exerted by rocket motors may prove very valuable in spite of low efficiency. This special case is the take-off of airplanes in general and the catapulting of airplanes in particular. It is well known that the take-off (especially of heavily loaded seaplanes) often meets with considerable difficulties and that a very long "run" is required until flying speed is attained. Other airplanes often face the same difficulties especially when overloaded and when taking off from smaller airports. If it were possible to furnish additional power only for the few seconds of the take-off many problems of modern aviation would become much easier to solve.

A rocket motor suggests itself for this purpose. An airplane engine with a thrust of 1,000 kilograms or 2,200 pounds is a rather big affair, but five rocket motors of the type "1.7/200" could furnish another 1000 kilograms for 20 seconds. They would use up 170 kilograms of fuel, 40 kg. of which would be gasoline. The five rocket motors (of exactly the type that has been constructed and tested) would weigh approximately 27 kilograms, while a specially constructed 1000 kg. rocket motor would probably weigh 40 per cent less.



O — Oxygen Intake
F — Fuel Intake
T — Point where combustion starts
NN — Two of the four exhaust nozzles
Rocket motor for liquid fuels designed by Professor Hermann Oberth.



One of the large "repulsors" of the German Rocket Society. The weight was appr. 70 kilograms, the altitude reached somewhat over 2,000 ft.

These figures sound rather high but the example has purposely been carried to the extreme to show that even then it might still be taken into consideration. Actually, an additional thrust of 2200 lb. will greatly exceed the demand, although without experimentation it will be very hard to tell how much additional rocket thrust will be most advisable and most convenient for a given type of aircraft. Actually the method has been tried as early as 1929 by the Junkers plant at Dessau, Germany. As far as we know the experiments were made with batteries of the largest type of powder rockets known. The airplane used was a Junkers hydroplane of the "Bremen" type, weighing a little over two tons. The results were officially reported as "very satisfactory and encouraging" but no data were published.

The advantages of the "launching rocket" are numerous and rather important. It will facilitate the take-off of airplanes especially from limited space. Furthermore it will obviate the need for too powerful motors in certain types of aircraft and reduce fuel consumption. It will enable the pilots of glider airplanes to take off without help. It is conceivable that launching rockets might replace catapults in general, which would be a very considerable gain in capital expenditure. In addition to all this the pilot would "carry his catapult with him" and would be in a position to take off again after a possible forced landing from a limited ground.

The disadvantage of the launching rocket is its own dead weight (between 20 and 40 lb.) and the dead weight of the oxygen containers. The oxygen itself will be used up during the take-off so that there is no need to take it into consideration.

If we assume that a certain type of aircraft demands an additional thrust of 200 kg. for 20 sec. the additional weight would be 6 kg. for the rocket motor (this will probably be reduced later to about 4.5 kg.), 34 kg. for the fuel. Of the latter there are 8 kg. of gasoline, so that 26 kg. of oxygen would have to be carried. In the liquefied state 26 kg. of oxygen are approximately 25 liters. The container would weigh around 15 kg. so that the additional weight would be 20-22 kg. This is by no means prohibitive.

Time Marches On

. . . So Must Sales

When a company sells more airplanes than anyone else in a year and then contracts for more engines than have ever been involved in any previous commercial order, it is time we looked into their sales methods. Here the sales manager tells how he did it

By T. V. Weld
Sales Manager
Taylor Aircraft Company

TWO simple words express the ultimate goal of all merchandising effort. They are "continuous activity." It doesn't matter whether you are selling fish or fruit or furniture. The clock keeps going round and around and with it goes the overhead. And not even the most eloquent alibis of master salesmen have ever halted or retarded time in its flight.

Like going to Heaven, there are many, many recommended methods of attaining continuous activity in a sales force. We have tried most of them during our five years of selling Cubs and out of this long experimentation, and a thorough study of merchandising methods in many fields, have evolved the present plan. Because we were exploring a brand new field of merchandising we approached the problem with open minds and refused to embrace any theory with a fixed determination to make it work. Rather, we felt our way along and made modifications in our methods whenever the occasion demanded them. Our progress has led us through most of the intermediate steps from small volume factory sales to a closed territory selling organization including all 48 states and some 35 foreign countries. Our present system involves distributors, dealers, factory representatives, and export agents. But let us go back to examine the beginnings.

First sales were made by factory representatives and advertising. We soon learned that planes were not sold by ads alone. The advertising campaign had to be supplemented by demonstration and personal sales effort. This is true to a lesser extent today than it was in the beginning. But it is still true.

Next we stepped into the field of open territory dealerships which seemed to be the best way to close the greatest number of sales. But the majority of our purchasers then were operators who bought ships for instruction and other non-scheduled activities. They wanted five or more states of closed territory. The Mississippi Valley was about the right size. Pilot Jones of Gallipolis, Ohio, knew someone he thought he could sell in Springfield, Ill. Some day Jones would be around Springfield and he hoped to make the sale. In the meantime and forever he wanted Illinois in his territory.

Obviously large closed territories would not work so for a while we tried open territories. Dealers were allotted closed areas only in their home cities and counties. This arrangement made us consume a lot of aspirin. It was inefficient and unfair. For example, a sincere dealer or agent would spend a lot of time bringing a prospect up to the purchasing stage. Final closing of the sale might be delayed by financial problems of the prospect. Another dealer happens in at the right moment and closes the deal. The first dealer is discouraged. The total effort of both dealers might have been used on many more prospects.

To remedy these defects we turned gradually to the closed territory system of dealerships, devoting all possible effort to assist dealers in closing sales in their territories. Factory representatives called on dealers to assist in closing sales. Prospect lists secured from advertising were promptly forwarded to dealers. New ideas in advertising and selling were relayed to them. And we helped them handle "trade-ins" and with the problems of transportation and delivery.

Sales increased considerably under this plan. Prompt demonstrations were provided for prospects. Flight instruction, mechanical service, and assistance in deliveries were available to new purchasers. Our visions of a huge organization, inefficiently managed from a home office and draining our resources, began to fade. But our progress was spotty. The territories of energetic dealers showed a high percentage of sales to population and per capita wealth while others showed little or no activity. In many instances we found a dead territory could be revived through instruction and encouragement of the dealer by a factory representative. Where a dealer showed lack of interest or poor sales ability our factory men could replace him.

This experience revealed two facts: (a) local dealers required the assistance of outside men to a great extent, (b) many of our energetic dealers showed the ability to work large areas. This led to the division of the country into distributorships headed by dealers of demonstrated ability. The new arrangement also solved the problems of delivery, service, trade-ins and, before the days of time payments, the handling of a few bankable notes.

Under this system a distributorship could assure sufficient return on invested capital and a dealership might well be a substantial asset to a local airport or flying school whose operator could not devote his entire time to sales work or employ salesmen. In spite of the rapid growth of the low priced plane field, we have found that Cub sales in a small territory cannot yet be depended upon as a sole source of revenue for an individual. But the relations of distributors and dealers to the company cannot be rigidly fixed for long periods of time.

Distributor contracts

Our distributor contracts, reproduced herewith, are drawn as simply as possible. We require that a distributor purchase a given number of Cubs during a twelve months' period. If he is unable to fulfill this requirement in any given month, he is privileged to pay a deposit on his quota and take delivery later. The company, in turn, pays the distributor an underwrite on all sales in his territory. As a stimulus to activity, this underwrite, or distributor commission, is based on the quantity of "Cubs" sold and increases up to a certain volume of business regardless of the quota specified in the distributor's contract.

In case a distributor is unable to fulfill his contract, he is "demoted" to a dealership without extensive financial loss to himself. While the company may lose some sales through inadequate operations in such cases, it is immediately able to appoint another distributor for the area and the company or individual who failed to make good as a distributor remains an asset to the company as a dealer.

We require that the distributor maintain a demonstrator and at least one Cub in a showroom or hangar. This insures his ability to display an absolutely new plane to prospects and assists in making immediate or prompt delivery to purchasers. The distributor must devote his entire time to the business of selling Cubs or employ a full time salesman for this work. He must cover his territory at least four times a year, assist dealers in closing and building sales, relay the prospect list secured through our national advertising to the proper dealer, and otherwise arrange to contact such prospects.

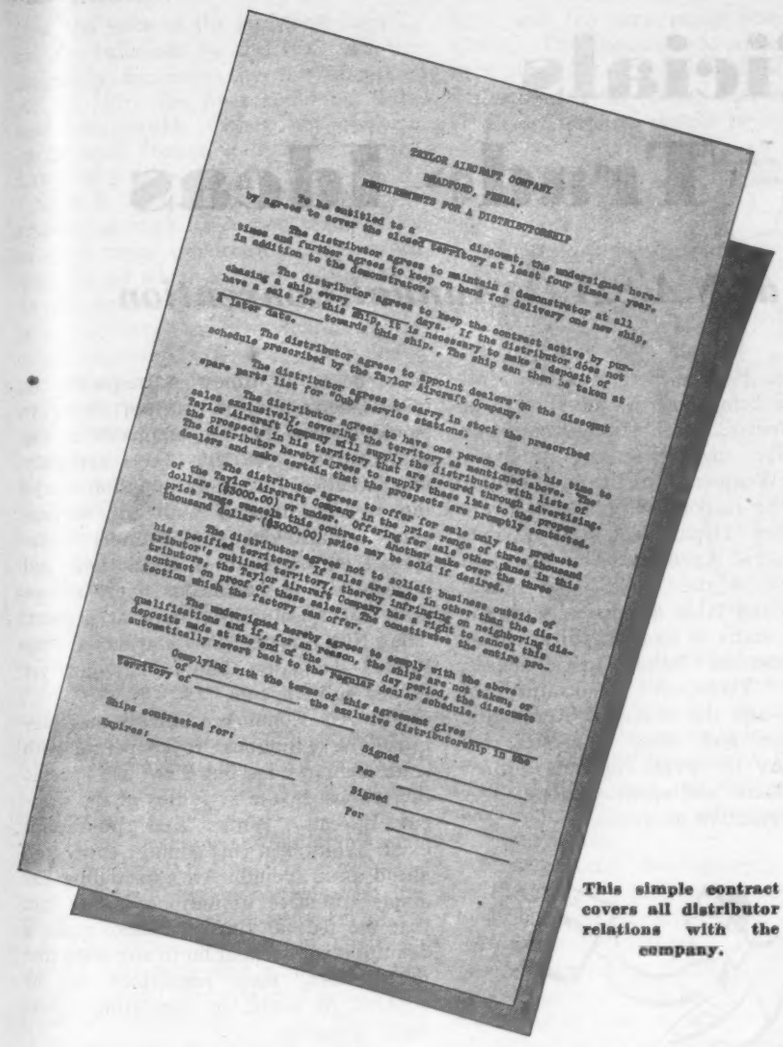
Dealers

Dealers are appointed to handle a certain percentage of population but do not have closed territories. In large cities, for instance, several dealerships are feasible at present and, as the market broadens, additional dealers may be possible. However, we are considering future possibilities of such scope that each dealer will conceivably market more Cubs than our distributors do at present.

We consider territory in the immediate vicinity of the airport, or dealer's base, as his selling area and discourage a duplication of effort. Yet it is impossible to prevent a prospect living near one airport from purchasing from a former instructor or friend located at another airport. At present our dealers are authorized to sell anywhere in the territory of their distributors. The man who closes the sale gets the dealer's commission. This arrangement seems to be preferable to a finely drawn closed territory plan.

A sale recently consummated illustrates how our system works. A prospect whose residence is in Brunswick, Georgia, spent some time in Iowa.

Two Cubs can ride as cheaply as one on this Taylor trailer.



TAYLOR AIRCRAFT COMPANY
BRADFORD, PENNA.
REQUIREMENTS FOR A DISTRIBUTORSHIP

To be entitled to a _____ discount, the undersigned hereby agrees to cover the closed territory at least four times a year.

The distributor agrees to maintain a demonstrator at all times and further agrees to keep on hand for delivery one new ship, in addition to the demonstrator.

The distributor agrees to keep the contract active by purchasing a ship every _____ days. If the distributor does not have a sale for this ship, it is necessary to make a deposit of $ _____ towards this ship. The ship can then be taken at a later date.

The distributor agrees to appoint dealers on the discount schedule prescribed by the Taylor Aircraft Company.

The distributor agrees to carry in stock the prescribed spare parts list for "Cub" service stations.

The distributor agrees to have one person devote his time to sales exclusively, covering the territory as mentioned above. The Taylor Aircraft Company will supply the distributor with lists of the prospects in his territory that are secured through advertising. The distributor hereby agrees to supply these lists to the proper dealers and make certain that the prospects are promptly contacted.

The distributor agrees to offer for sale only the products of the Taylor Aircraft Company in the price range of three thousand dollars ($3000.00) and under. Offering for sale other planes in this price range cancels this contract. Offering for sale other makes over the three thousand dollar ($3000.00) price may be sold if desired.

The distributor agrees not to solicit business outside of his specified territory. If sales are made to other than the distributors qualified territory, the Taylor Aircraft Company has a right to cancel this contract on proof of these sales. Company infringing on neighboring distributors territory thereby has a right to cancel this contract in section which the factory can offer. This constitutes the entire proposition.

The undersigned hereby agrees to comply with the above qualifications and if for any reason, the ships are not taken or deposits made at the end of _____ day period, the discounts automatically revert back to the regular dealer schedule.

Complying with the terms of this agreement gives _____ the exclusive distributorship in the Territory of _____

Ships contracted for: _____
Expires: _____

Signed _____
Per _____
Signed _____
Per _____

This simple contract covers all distributor relations with the company.

While there he took dual instruction from a Cub dealer and became interested in purchasing. A little later this prospect purchased a Cub from a dealer in Florida. The dealer in Florida received the dealer's commission on the sale. The distributor in Georgia received the underwrite on the sale and the Iowa dealer, who failed to close the sale, had to charge his work to goodwill. This is as fair a plan as we can conceive.

Our distributor and dealer contracts might be drawn to great length to cover the many angles of Cub merchandising. But we cover the fundamental issues in the simpler agreement and the main issue of our requirements remain the same. We want "continuous activity" regardless of the number of words used to say it. In return, we furnish dealers and distributors every assistance possible to make their merchandising a profitable undertaking. It is our sincere desire to have some dealer earn a commission on every Cub sold.

In our distributor contracts, we reserve the right to cancel if sales are made outside the allotted area. This applies to dealers as well as distributors. In case of violations, we are able to credit the proper distributor and charge the amount of the commissions back to the violating dealer or distributor. So far, our only action in this respect has been due to mistakes.

From the foregoing, it is apparent that the "duds" among our dealers automatically eliminate themselves. Other dealers get the orders and the commissions. Dealers who unwisely undertake a distributorship are, in the course of time, returned to their former status. This also seems a fair proposition to all concerned.

Delivery, used planes, financing

We now have 28 distributors in the United States. In one of our largest problems, that of delivering Cubs to purchasers at low cost, the aid of these distributors is invaluable.

Two concerns in the far west, Aircraft Associates, of Long Beach, Calif., and Art Whitaker, of Portland, Oregon, have kept trailers which carry two Cubs on the roads continuously for long periods of time this year. On several occasions two or three pilots, either purchasers or dealers, have ridden to the factory on these trailers and flown planes west while two rode the trailer. We also have two trailers of our own which are constantly in use ferrying Cubs. We have shipped by rail and steamer and many Cubs have been flown to purchasers. Although costs of delivery by distributor cooperation may not be greatly reduced, the assistance of distributors in the details of delivery is valuable to us, and is far more satisfactory to the purchaser than anything we could work out unaided.

Before the advent of the distributor system, we were forced to devote considerable effort to handling and disposing of trade-in or used airplanes. Now our trade-ins are handled entirely by the distributor and dealer. We do not allow a discount on deals where a used airplane is accepted by the company in partial payment. The dealers and distributors are in the field where the prospects are handy and this arrangement is by far the most economical means of reselling used planes. Frequently, the dealers have buyers waiting before accepting a trade-in.

In the financing end, the dealers and distributors are on the ground and easily able to ascertain the soundness of a prospective purchaser's background. They are required to endorse the notes and contracts on deferred payment sales. After disposing of several hundred Cubs on the finance plan, we have experienced practically no losses, either to the Taylor Company, the finance companies, or any of the dealers.

The consumer pays

The underlying aim of our company is to produce a good plane at the lowest possible cost. In his five years of financing and managing the company, the efforts of Mr. William T. Piper have been constantly devoted to reducing overhead. Five hundred dollars a month overhead to produce ten planes is $50 a plane. On the 50 planes which could be handled with the same cost, the overhead would be reduced to $10 per plane, or a saving of $40 to the purchaser.

The same principle applies to selling costs. Whatever is expended in merchandising the plane must be added to the retail price. Hence our effort to build a selling organization that will dispose of 50 Cubs at the former cost of selling ten has a direct and important meaning to prospective fliers, with limited financial means.

State Officials Trade Ideas

with Federal Officers at N.A.S.A.O. Annual Convention

STATE officials from Florida, California, Connecticut and a good many intermediate points gathered at Hartford, late in September for the annual convention of the National Association of State Aviation officials. But state officials were not the only guests of Connecticut Commissioner C. L. Morris and his staff. A large representation of members of the Bureau of Air Commerce and other federal agencies attended and several guest speakers from high places in the industry were there.

New officers: President, Gill Robb Wilson, New Jersey; first vice-president, Floyd E. Evans, Michigan; second vice-president, A. B. MacMullen, Florida; third vice-president, Charles L. Morris, Conn.; legal counsel, Fred D. Fagg, Jr., Illinois, and George B. Logan, Missouri. Regional vice-presidents are C. Vinet, Pennsylvania; R. O. Lindsay, Tennessee; E. B. Cole, Illinois; J. K. Baldwin, Wyoming; D. O. Langstaff, Louisiana; A. M. Smith, Nevada; Dr. R. Staub, Oregon.

The program was fast moving and interesting to many divisions of the industry. It is impractical to attempt to reproduce it verbatum and detailed proceedings will be published in due course by the association. Herewith we present some of the high spots.

Need Commission Control

Theme song of the opening address of President Fred B. Sheriff was the need for a permanent federal aviation commission. He paid high tribute to the report submitted by the F.A.C. in 1935 and added that "The hearings of the Copeland Committee, it seems, have merely served to emphasize the sanity of the conclusions of the Federal Aviation Commission."

Safety in the air depends in a large measure upon the establishment at Washington and in the various states of commissions on aeronautics composed of technicians secure from the hazards of politics. To urge establishment of a federal aviation commission in Washington and state commissions in those states that do not yet have such bodies is the finest work the National Association of State Aviation Officials can undertake. The Federal body would do all work now being done by the Bureau of Air Commerce, the Interstate Commerce Commission, the Department of State, and the Weather Bureau, and assume most of the responsibility vested in the Post Office Department and various other Federal Agencies. The Board of Governors of the N.A.S.A.O. should hold a round table discussion with the executive staffs of such organizations as the Aeronautical Chamber of Commerce, the Air Transport Association of America, and the National Aeronautic Association and other interested organizations to decide upon a proper clearing house and sponsors to put over such a legislative program.

On the subject of Congressional laxity Mr. Sheriff said, "Congress cannot hope to be properly informed so long as it attempts to function without having special committees on aviation in both the House and Senate. Ever since the cancellation of air mail contracts, the Administration has repeatedly demonstrated that aviation in this country has outgrown its understanding, and I am sorry to say that by the same token a similar condition exists in many of the states."

In discussing safety, President Sheriff emphasized that in the 1350 pages of proceedings of the Copeland Committee only a few were devoted to the problem of safety in miscellaneous flying. As the ratio of miscellaneous to scheduled airline pilots is about 40 to 1 and as accidents occur 10 times as frequently in miscellaneous than in transport flying, it would appear that the emphasis of the committee's work has been seriously misplaced. A federal commission working in coordination with the various state commissions could render widespread enforcement of regulations and educate the miscellaneous flyers to operate more cautiously than at present. The N.A.S.A.O. has started a "fly safely" campaign but it has not yet gained full impetus.

The Air Commerce Bureau has signified its willingness to cooperate with state commissions but there are specific limitations on the activities of the present Bureau. While these limitations exist, aviation in this country cannot go ahead as it should. An outstanding example of these limitations is the fact that the federal Bureau cannot make a definite recommendation to any state that the uniform state regulatory act be adopted to assist in regulating intrastate operation.

Speaking of airport development, Mr. Sheriff expressed N.A.S.A.O. appreciation for the Federal aid WPA, FERA & CWA, and urged the continuance of assistance of the federal government beyond the extent of the present relief programs. The WPA program had several troublesome setbacks that should be avoided in future development: (a) an executive order discontinuing work on airport sites that were leased by local municipalities, (b) failing to complete projects on sites bought by communities with the distinct understanding that airports were to be built on them (c) preventing state officials (who demonstrated remarkable ability to get work done under CWA) from acting as supervisors. Here again a federal aviation commission could have been helpful in ironing out these difficulties.

Airlines and anti-trust laws

If the airlines were removed from the category of manufacturers of pork and beans and placed on a par with other transportation agencies, they could make tremendous progress, said Col. Edgar S. Gorrell, president of the Air Transportation Association of America. Freed

from the yoke of the anti-trust laws as are the railroads by the ICC and the steamship companies by the Maritime Act of 1916, the lines could not only save considerable money but compete on an equal footing with contemporary forms of transport.

Since it is the first duty of any government to mark its oceans, it should be an even more important obligation to mark the air which is the greatest ocean. At present about five of the 28,000 miles of our airways have no markings. It would require $14,000,000 (the amount spent every four days for concrete highway construction) to bring the airways up to "bulletproof" safety. An alternate emergency program would improve them to a reasonable degree at a cost of $5,000,000. These plans were placed before the last session of congress. There was a unanimity of desire on the parts of House and Senate to see them through. They did not go through for reasons better undiscussed at this time.

The present Bureau of Public Roads grew from two men called the "Bureau of Road Inquiry." There is an urgent need for a "Bureau of Public Roads for Air." No congressman could be against it for the airways benefit 43 states and the territories.

Reasons for more and better airways are:

1. Safety—This is obvious. It requires no further explanation.

2. Efficiency—The airlines don't fly now in extremely bad weather. Better airways would increase regularity. Air transport should operate on schedules as monotonous as Pullman travel.

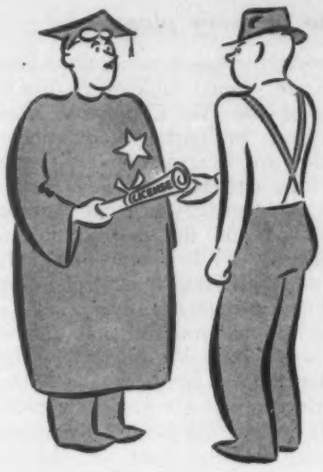
3. To keep operators out of jail. The law infers the airlines must be out of the red by July 1, 1938. The deficit is nearly $3,000,000 a year. If more schedules could be flown this could be balanced out.

4. National Defense. If we were attacked on both coasts the Navy could be in only one ocean. We must build air roads to facilitate national defense.

A law that requires the airlines to drop off passengers paying 54 cents a mile for mail paying 36 cents per mile, requires the lines to run into red ink. The limitation of payment to 40 cents per mile is unfair and should be altered. The airlines should be paid for service rendered.

Licensing airports and managers

The Air Commerce Bureau is about to recommend that all transport airports have a certificate of suitability for operations according to John Wynne, Chief of the Airport Section of the Bureau. There should be three classifications of airports: (a) terminal airports with minimum requirements, (b) intermediate fields on the Federal airways, and (c) ports under State supervision. The status of the airport manager also is soon to be defined by the Bureau. It is the feeling that managers of airline airports should be registered



and licensed by the Federal Government. Managers of state supervised fields would then be licensed by the state. With the inevitable increase in municipal airports, resulting from the W.P.A. program, Mr. Wynne felt this step was necessary to combat possible local political interference.

Most recent developments in the W.P.A. airport program were outlined by Lieut. Col. Sumpter Smith, Principal Aeronautical Engineer. Present purpose of the airport division, W.P.A., is to salvage from the depression by the use of relief labor as many useful units of airport work in the program as is possible. Assuming the continued employment of the present number of employables the funds available will last until about March 1, 1937.

By the very nature of the program, the local community must apply for and select from the approved list and establish the priority of projects to be constructed.

In order to include buildings and other other expensive facilities such as lighting, paved runways, etc., in an airport project, means must be found to reduce the man-year cost of the particular project. This may be accomplished by (a) additional local sponsors' contributions or (b) grouping all the projects in a community so that their average conforms to the standard man-year cost. The latter method has been done in several important centers including Newark. Col. Smith stressed the need for a permanent national airport plan and suggested that an effort be made to develop one by the permanent federal and state aviation organizations.

During the discussion on "flight strips" it was brought out that the development of "flight strips" in areas adjacent to the highways, connected with and being part of highway rights-of-way, should be actively encouraged by the National Association of State Aviation Officials and the American Association of State Highway Officials, in order that these two groups might submit a detailed report and definite plan. This plan should include:

(a) Detailed report showing location, size and condition of existing airport facilities;

(b) Recommendations as to the location of airports and "flight strips" needed to complete our National Airways System;

(c) Detailed plans for the construction of necessary "flight strips" including probable cost, etc.

These flight strips would not only increase the safety of persons actually in the air, but would also tend to eliminate the possibility of forced landings on highways with probable damage to property and injury to persons traveling on the highways. The program for a nationwide development of "flight strips" was presented at the last annual NASAO meeting by Stedman Shumway Hawks.

Foundations of air policy

To vest in any man susceptible of ready removal from office the simultaneous responsibilities of making regulations, discovering violations, making arrests and acting as the court of first instance, court of appeal, and executioner, is incompatible with our system of government. Federal air policy must be continuous and must survive many administrations, detached from partisanship. Politics should stop at the air's edge as it once was paid to stop at the water's edge. Air policy must conform with the first principle of sound governmental theory —segregation of executive, legislative, and judicial functions. Thus Edward P. Warner, former editor of AVIATION, began his address at the final luncheon meeting of the convention.

Two examples of control by an individual (without relation to any encumbent) are (in the speaker's opinion):

(a) The directorship of air commerce; (b) the post office department. In the case of the latter the situation has been remedied somewhat by bringing the ICC into the air mail picture.

In the past there has been no assurance of continuity in air transport policy. Progress cannot be made satisfactorily with revisions of law each one, two, or three years, or of contracts every four to eight years. The distribution of government aid is a delicate judicial function extraordinarily subject to the suspicion of abuse, and it is unfair to the Postmaster General to carry its responsibility. The ICC responsibility is not broad enough nor is clearly enough defined.

The second fundamental point in air policy is that it should place a limit on governmental responsibility. It should protect the man on the street, the passenger, the purchaser of a plane but it should not protect the individual against himself. At a recent air race there were many complaints that the Air Commerce Bureau was neglecting its job by permitting stunt flying. There is a distinction however, between the regulation of public safety and the protection of an individual against himself. An ATC plane should have a certificate of performance and there should be a "flying qualities" and "ease of operation" certificate.

The third point in air policy foundation is concerned with transport. Its needs are as follows:

1.—There is needed a more orderly and automatic system of awarding aid to operators. It is a fetish in Washington that competitive bidding is the only way of letting contracts. This system has twice broken down in mail contract awards. Only recently the ICC had to be given the right to adjust rates.

2.—Contractors' compensation should be proportionate to service rendered. Routes should be paid basically for what they carry.

3.—If it is felt that services must be extended where traffic is slight, the uneconomic nature of the resultant line should be recognized and direct aid should be given to support it.

4.—Close control should be exercised over the economics of air transport in all phases.

5.—Good operating practice should be promoted. Excess of profit is not clearly defined in the air mail act. The present system approaches the cost-plus method which always places a bonus on waste.

6.—Transport operation should be open to competition, with control vested in some responsible agency. The speaker expressed his leaning toward a special commission but said the ICC was doing a good job and there are some advantages in this arrangement.

7.—Subsidies to air mail operators should be self cancelling.

Radio in every plane

Among the speakers at the "Federal and State" round table were J. Carrol Cone, of the Air Commerce Bureau, who said in part, "Regulations as a rule are distasteful to free-born American citizens and they are especially so when they are not thoroughly understood and the desired objectives appreciated. When our first bulletin regarding air traffic control of non-scheduled instrument flyers was published, it was practically in the same category as the Volstead Act—so unpopular that it could not be enforced. The Bureau was not given the cooperation it desired due largely to misunderstanding on the part of the pilots affected. But since we have called several conferences of representatives of all phases of non-scheduled instrument flying and discussed this matter in detail with them and then rewritten the original bulletin in the form of a regulation, we are getting splendid cooperation from all parties who understand our motives in setting up traffic control regulations governing non-scheduled instrument flying.

In the discussions that followed Colonel Cone stated that it now appears that at some future time the Bureau will probably be forced to require at least a radio receiver on every plane flying along any designated air route if it were to operate to and from congested air line terminal airports. It was later emphasized by Director Eugene Vidal that this regulation would apply only if the ship was to operate in or out of a terminal airport."

This question was discussed at all of the airport conferences last year of the Airport Committee, Aeronautical Chamber of Commerce. See AVIATION, *July 1936, pp. 29—Ed.*

Mr. Jerome Lederer contributed the thoughts that there should be a standby radio power plant at each traffic control office; when neighboring auxiliary airports are used, area control should be substituted for line control as in Germany; radio equipment should not be piled up in towers in such a way as to destroy vision; towers should be air conditioned and soundproofed; qualifications of operators should be carefully considered; and ships should not be permitted to warm up under control towers.

Airports can be classed as regional or national and the dividing line between federal and state supervision should be at the point where the airplane wheels touch the ground in the opinion of Edward P. Warner. It is not good government practice nor is it the best thing for aviation for the federal government to furnish the surface development. It encourages the localities to lie down on the job.

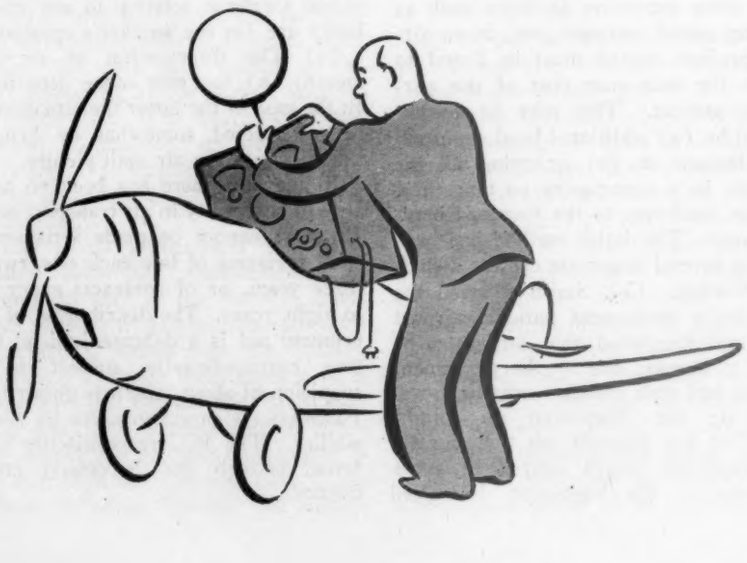
It is too late to control traffic when unregulated until it is circling a traffic controlled airport. Control in terms of time and altitude must extend from take-off to landing and the question of whether a municipal employee in a traffic control tower can exercise jurisdiction over aircraft over another state is still to be determined in the opinion of New Jersey State Commissioner Gill Robb Wilson.

What future planes should be like

Future plane features should include perfect visibility, elimination of spinning, stability in stall, glide path control, braking equal to an automobile, a wide range of landing speeds, and two controls. It is also desirable to have minimum flying speed below 35 m.p.h. and ability to climb out of a small field. Not low landing speed but low crash speed is desirable. There is much more chance of surviving a crash at 35 m.p.h. than one at higher speed. Flying altitude is selected on the basis of crash danger and pleasure of flying is inversely proportional to altitude. Another development for safe crashing may be the airplane parachute but this is only for small planes.

Radio requirements already have closed at least one airport to the private flyer. Other exclusions will follow. It will then be necessary to move out to smaller fields and the plane of the future must be built for them. Landing strips and roadable planes offer an excellent solution. The roadable autogiro is already successful and the Waterman roadable tailless plane is now operating on the Coast (road speed, 70 m.p.h.)

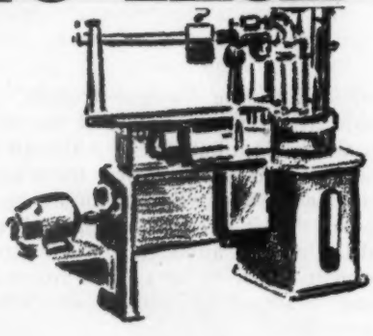
(*Turn to page* 47)



POUNDS

Power plant design and aerodynamics have reached a state of development where some radical innovation will have to be introduced to cause any noticable acceleration in the rate of progress. In structural design, however, there still remain real opportunities to increase overall efficiency. The author's study of strength weight relationships points up some of them. The first of two articles.

Pounds or Square Inch



By F. R. Shanley*

** Although the author is a member of the staff of the Bureau of Air Commerce, these articles reflect his opinions as an individual engineer.*

IN these days of stressed-skin construction, designers have become fully aware of the fact that the commonly-used strength-weight factors for various materials are of small significance. There is a general understanding that stiffness becomes of greater importance than strength in many cases. Yield stresses are almost always of greater interest than ultimate tensile stresses. A clear conception of the various factors involved will not only indicate the relative merit of different materials but will explain why certain forms of construction are more efficient than others and will also give some idea of what to expect in the future.

Before proceeding further consider just what the term "strength-weight factor" means. (The term "factor" is here used instead of the more usual term "ratio.") It certainly is not non-dimensional, at least in its usual form. Some method of reducing it to coefficient form (so that it would have the same value in all systems of measurement) could probably be worked out by establishing standard basic dimensions. This will not be attempted here, however, as we are interested in the comparative merits of different materials, not in the individual factors for each material.

As will be shown later, in some cases there is actually a large numerical difference in the results obtained by using "strength-weight" or "weight-strength" factors. We shall therefore define "strength-weight" as meaning the ratio of strengths for constant weight, assuming the basic dimensions to be held constant. Conversely, "weight-strength" means the ratio of weights for constant strength, under the same general conditions. The designer will usually be more interested in "weight-strength" factors, as the strength required is more or less independent of the material or type of construction, and the object is to reduce the structural weight as much as possible. Very little is to be gained by increasing strength beyond certain limits but there is no apparent limit to the increase in pay load obtainable by reducing the structural weight. On the "strength-weight" basis goal is infinity,

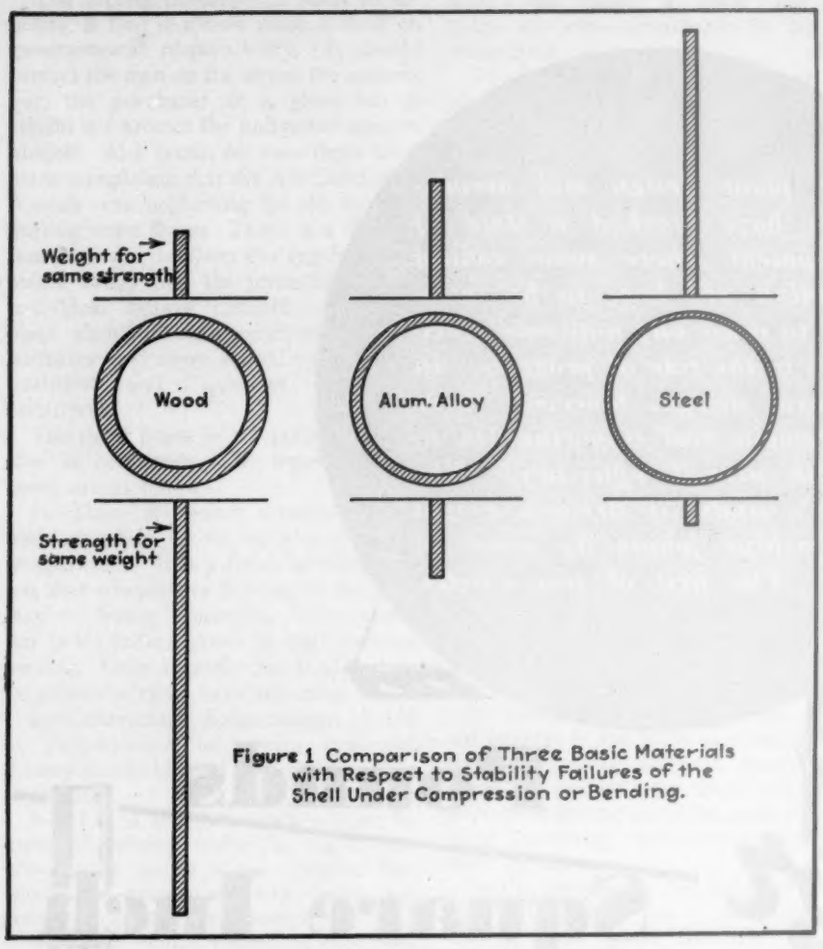


Figure 1 Comparison of Three Basic Materials with Respect to Stability Failures of the Shell Under Compression or Bending.

while with the "weight-strength" the objective is the reduction of the structural weight toward zero. Although this offers an attractive subject for speculation and debate, we shall not attempt to prove that it is easier to approach zero than infinity, although zero structural weight seems to be a more reasonable and practical objective than infinite strength.

Wing and fuselage

The two practical cases in which we are most interested at present are the wing and the fuselage. We shall begin by assuming that the external dimensions have been decided on and that they are to remain substantially unchanged. That leaves the designer with a choice of material and type of structure. Since there are an infinite variety of structural types, it is easiest to consider two extreme cases and then to combine the results when dealing with intermediate forms of construction.

We therefore reduce all stressed-skin structures to two basic types, classified as to the nature of the failure. Type I is that in which failure occurs at some definite stress, which is a function of the material only. It could be either the ultimate tensile stress, or the yield stress. For simplicity we can refer to this limiting type of failure as a "stress failure." For Type II failure occurs through instability of the structure. Such failures depend essentially on the dimensions of the structure and the elastic properties of the material. The actual value of the stress has no direct significance, except in cases where it affects the elastic properties. We can conveniently refer to this sort of failure as a "stability failure."

It will be unnecessary to derive the strength-weight factors for Type I failures, as it is obvious that the two basic material characteristics involved are the failing stress and the unit weight. If we denote the failing stress by F, and unit weight by w, the strength-weight factor will be proportional to F/w and the weight-strength factor will vary as w/F. We can avoid difficulties about units of measurement by using arbitrary constants which will cancel out when comparing different materials. The two factors for Type I failures then become

$$(S/W)_{\text{I}} = C\ (F/w) \qquad (1)$$

$$(W/S)_{\text{I}} = C\ (w/F) \qquad (2)$$

These two factors are obviously reciprocals and either can be used in comparing different materials.

Geometry of the structure

In dealing with Type II failures it is necessary to know something about the geometry of the structure. The simple case of a round tube in compression can be used as a basis, as the results can be shown to apply to more general cases. Assuming that the round tube represents a fuselage, for instance, we can take the diameter ($2r$) as constant, leaving the wall thickness (t) variable. The critical stress at which the walls will buckle due to instability has the general form (NACA Report No. 473):

$$F_c = K\ E\ t/r \qquad (3)$$

Since the strength, S, equals F_cA, (where A is the cross-sectional area), and since the cross-sectional weight, W, is proportional to wA, the strength factors become, after substituting for F_c and combining constants,

$$(S/W)_{\text{II}} = C(tE/w) \qquad (4)$$

$$(W/S)_{\text{II}} = C(w/tE) \qquad (5)$$

These results can be derived for the case of bending failures and will represent torsional instability failures fairly well also. (It can be shown that for torsion a closer approximation is obtained by raising t to the 5/4 power, but such refinements will be left for further development).

The strength-weight factors so far derived for Case II are interesting in that they show that the failing stress F for "stress" failures is replaced by the factor Et. This result, however, is not new and fails to give us a factor which is a function only of the material. Our problem now is to eliminate t from Equations (4) and (5). It is here that the new idea of holding either the weight or the strength constant gives us a clue to the solution.

Since we are usually dealing with constant strength, consider that case first. The total strength against compressive failure due to instability is equal to F_cA, where F_c is found from Equation (3) and A is the cross-sectional area. Replacing A by its value for a thin-walled tube ($2\pi\ r\ t$) and again employing a general constant, we get

$$S = C\ E\ t^2 \qquad (6)$$

If the strength, S, is held constant, Equation (6) can be solved for t, giving

$$t = C/\sqrt{E} \qquad (7)$$

Substituting this in Equation (5) we

get the answer, for the case of constant strength, in the form

$$(W/S)_{II} = C\ (w/\sqrt{E}) \qquad (8)$$

By a similar process, holding the weight constant, the solution can be made for the "strength-weight" factor,

$$(S/W)_{II} = C\ (E/w^2) \qquad (9)$$

The results are summarized in Table I.

TABLE I
FACTORS AFFECTING STRENGTH AND WEIGHT OF SHELL-TYPE STRUCTURES HAVING SAME OUTSIDE DIMENSIONS

	TYPE I "Stress" Failure	TYPE II "Stability" Failure
W/S (Strength Constant)	w/F	$w/\sqrt{E}$
S/W (Weight Constant)	F/w	E/w^2

F = Failing Stress of Material
w = Unit Weight of Material
E = Modulus of Elasticity of Material

Comparing the two results, we find that the *strength-weight* factor is *not* the reciprocal of the *weight-strength* factor in the case of monocoque structures which fail through instability. It is, in fact, proportional to the *square* of the reciprocal. As a simple illustration of what this means, assume that two identical monocoque structures are reproduced in different materials so as to have the same strength. If the weight-strength factors of the two materials are in the order of 1 to 4, the structural weights will also vary in that proportion. If, however, the *weights* of the two structures are held constant, one will be 16 times as strong as the other. This result, although somewhat surprising, is of no special interest except to indicate the importance of choosing the proper factor to work with. It does, however, have some significance in connection with military aircraft which are built to high strengths.

An important conclusion which can be drawn from the new weight-strength factor for monocoque shells is that the influence of E is greatly reduced in comparison with the influence of w, the unit weight. This should be of interest to those writers who have deplored the fact that certain otherwise promising materials have low values of E/w. Since it is almost impossible to do much about changing the modulus of elasticity (E) of any material, it is encouraging to find that it is not so important after all. It is obvious, however, that the unit weight, w, is very important and that much can be done along the lines of reducing w. In a later article it will be shown that most modern structures employing high-strength materials actually represent an artificial reduction in the cross-sectional weight by an increase in the effective thickness of the shell.

Without going into the many secondary factors that influence the choice of a material and type of construction, it will be of interest to see how these basic factors look when applied to some actual materials. In Table II the ratios of these factors have been computed for the three common structural materials, using arbitrary values for E and w. (These are of course subject to modification when applied to non-homogeneous construction and could be further modified to account for other factors, such as Poisson's ratio). The ratios of E/w are included to show how radically the new factors differ from those sometimes employed. Although E/w is roughly the same for all three materials, the table shows that a steel shell would weigh about 3.8 times a wood shell of equal strength. When considering equal weights, it appears that the wood shell would be nearly 15 times as strong as the steel, and 2.8 times as strong as one of aluminum alloy. The relationships can be visualized by referring to Fig. 1, which needs no further explanation.

TABLE II
COMPARISON OF VARIOUS MATERIALS FOR "STABILITY" TYPE OF FAILURE

	RATIOS				
	E	w	$\frac{E}{w}$	S/W $=\frac{E}{w^2}$	W/S $=\frac{w}{\sqrt{E}}$
Steel/Wood	22.3	18.2	1.23	0.0675	3.85
Steel/Alum. Alloy	2.78	2.8	1.00	0.354	1.68
Alum. Alloy/Wood	8.0	6.5	1.23	0.189	2.3
Wood/Steel			0.813	14.8	0.260
Alum. Alloy/Steel			1.00	2.82	0.595
Wood/Alum. Alloy			0.813	5.30	0.435

Extending the method

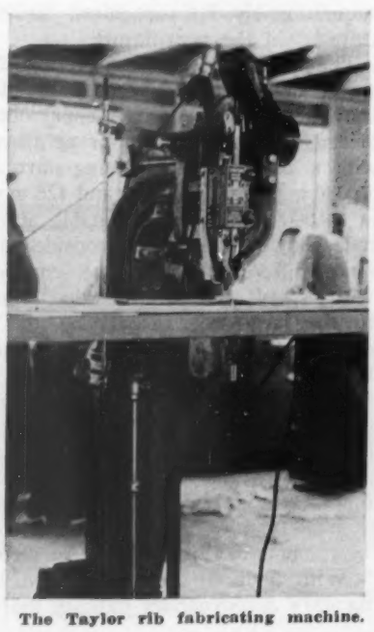
Obviously this method of attack can be extended to include intermediate types of failure and it offers a new approach to the general solution of the monocoque strength problem. Present methods of construction can be evaluated on this basis, but the most interesting possibilities appear to lie in the application of the theory to new materials and new forms of construction. The next article of this series will cover these points in greater detail.

★

Rib Fabricator

Taylor develops machine to rivet ribs in quantity

A DEVICE for fast and economical construction of airplane ribs has been developed by the Taylor Aircraft Company. The machine is a high speed riveter which punches and rivets the aluminum alloy stock without moving the work between operations. The operator places the corrugated stock in the rib jig and guides the jig to the correct place for rivets. Pressure on one foot pedal punches the hole and a second pedal is pressed for the riveting operation. The joints thus made stand up perfectly in static tests.



The Taylor rib fabricating machine.

How FAST?

I. Ultimate Maximum Speed at Sea-level

The first of a series of articles discussing the upper limits of airplane performance. Later articles will cover speed at altitude, range and ceiling

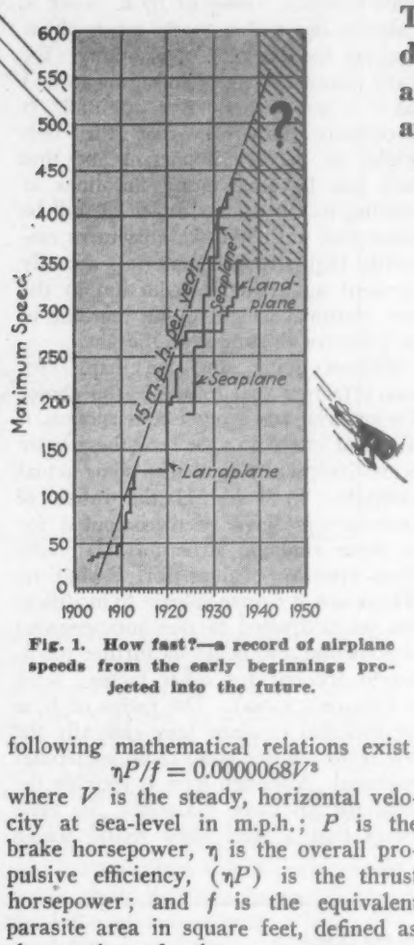


Fig. 1. How fast?—a record of airplane speeds from the early beginnings projected into the future.

IT was not until 1921 that any airplane officially exceeded 200 m.p.h. in level flight for even a few minutes, but within thirteen years that speed had been more than doubled. It has long been intriguing to speculate as to the future course of the graph shown in Fig. 1.

It is an interesting though meaningless fact that the maxima of the records appear to lie along a line whose slope is approximately 15 m.p.h. per annum, a rate of record-speed increase which is surprisingly low from some angles, surprisingly high from others. These records have all been made at sea-level so far—but new landplane records will unquestionably be recognized at high altitudes in the near future.

The Hughes racer, which did 352 m.p.h. at sea-level after a 1200 foot starting dive, would, if it could obtain the same thrust horsepower at altitude with a corresponding diving-start aid, do 386 m.p.h. at 10,000 ft. and 426 m.p.h. at 20,000 ft. Speed attainable at altitude, however, involves considerations quite different from those connected with speed at sea-level, due mainly to the large role played by the induced drag at altitude, and is therefore to be treated separately.

If we restrict ourselves to speed at sea-level the induced drag becomes negligible for small, high-speed airplanes. A consideration of the thrust horsepower required at sea-level then gives a simple picture of the difficulties ahead in attempts to raise the present records.

With induced drag neglected, elementary aerodynamics indicate that the following mathematical relations exist:

$$\eta P/f = 0.0000068V^3$$

where V is the steady, horizontal velocity at sea-level in m.p.h.; P is the brake horsepower, η is the overall propulsive efficiency, (ηP) is the thrust horsepower; and f is the equivalent parasite area in square feet, defined as the ratio of the parasite drag in pounds to the dynamic pressure in pounds per square foot.

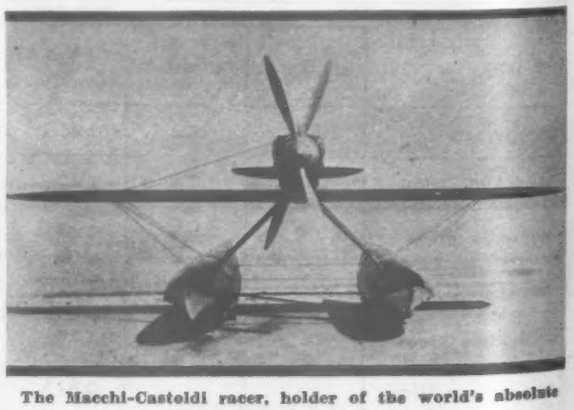
The quantity $(\eta P f)$ might well be termed the minimum "cost" of speed, since it is actually the minimum thrust horsepower required per square foot of equivalent parasite area for any given sea-level speed. Fig. 2 shows how increasingly rapidly this "cost" rises with speed. This plot of the above equation does not present the complete picture due to the absence of any allowance for induced drag, and also due to the fact that straight-away speed records usually have the advantage of some diving start. The advantage gained from the latter fact, however, like the loss from the induced drag, decreases with increasing speed.

As an example of the price to be paid in increasing speed, two transport airplanes are shown in Fig. 2 for comparison with three famous racing planes. The tremendous gap between the Ford Trimotor and the Douglas DST is well-known but it is small in terms of the "cost" of very high speeds.

Obviously, the way to meet the price is to increase power and decrease drag, and these become more and more difficult to do indefinitely.

The price limit

Inasmuch as there is a definite limit below which drag cannot be reduced,



The Macchi-Castoldi racer, holder of the world's absolute speed record.

then as speed is increased, there is reached a value above which the only way to meet the price is to increase the power faster than the drag. But even this cannot be continued indefinitely for conventional designs—a point is finally reached where we cannot pay.

The limiting price is set by the phenomenon of compressibility, which quickly becomes ever more active in boosting the quotation as the velocity of sound is approached.

Mr. Stack, of the N.A.C.A., in the first issue of the Journal of the Aeronautical Sciences, showed that, for a hypothetical, *very* clean conventional design, the drag increase due to the compressibility burble becomes too great to overcome at about 650 m.p.h. An increase based on Stack's data is included in Fig. 2.

While the price is extremely difficult to meet at even 500 m.p.h., the authors hesitate to place the *absolute* limit below 75 percent of the velocity of sound, i.e., at about 575 m.p.h., though to approach this limit would undoubtedly require radical design of wing and fuselage nose to counteract the compressibility price boost.

Future record holder

The question naturally arises: What kind of an airplane will possibly exceed the present absolute record? So many possibilities and difficulties are involved that the authors do not care to go so far as to present a three-view of what the plane might be like.

It is felt that the seaplane cannot raise its record very materially, *unless* retractable floats can be employed. However, there is plenty of room for improvement in the landplane record. The price for the Macchi-Castoldi was met largely by the use of a great amount of power (3100 brake horsepower)—that for the speeds made by the Caudron-Renault was met more by low drag. Both methods of paying must be used—but at the same time the landing speed must be kept down to not much more than 100 m.p.h., so that complicated high lift devices will be necessary if extremely high wing-loadings are used, but they do not present insurmountable difficulties. (An alternative might possibly be a variable-wing-area arrangement, such as is used, for instance, on the "Varivol" airplane now under development in France.) A different type of engine than that used to set the present landplane record will probably be required.

Flying engines

Suppose that we have a single-row radial engine of 55 in. diameter (frontal area 16.5 sq.ft.) developing 1250 bralie hp. for racing purposes. Consider the fictitious possibility of this engine, with its propeller and cowling and a streamlined nacelle, flying level through the air by itself. Then the equivalent parasite area would be about 1 2/3 sq. ft., so that for an overall propulsive efficiency of 75 percent, the maximum theoretical sea-level speed would be (neglecting compressibility) about 435 m.p.h. which is less than the world's record.

But if we now apply the same fictitious possibility to the Merlin engine, which has a frontal area of 5.85 sq. ft. and develops around 1000 brake horsepower, then the Merlin, flying with its propeller, cowling and streamlined nacelle, *and* radiator, should have an equivalent parasite area of say 3/4 sq. ft. which for 75 percent efficiency would correspond to a maximum possible sea-level speed of about 528 m.p.h.

Thus in the above hypothetical case, whether or not the comparison may be considered as entirely fair, there is a 21 per cent speed increase and an 18 percent power decrease in going from the first engine to the second.

In closing, the authors would like to urge an acceleration in the present American development of compact high-power air- and liquid-cooled in-line vee and horizontally opposed engines. Their *necessity*, from the viewpoint of very high speed, should be obvious for use not only in strictly racing planes, but in pursuit and fighter planes as well; their *desirability* for some of the larger types follows also. It is to be hoped that at least a fraction of the research work which has been devoted in the past to radial engine installations will be directed toward in-line cooling and cowling problems, and especially to the development of propeller blades designed specifically for in-line engines.

By

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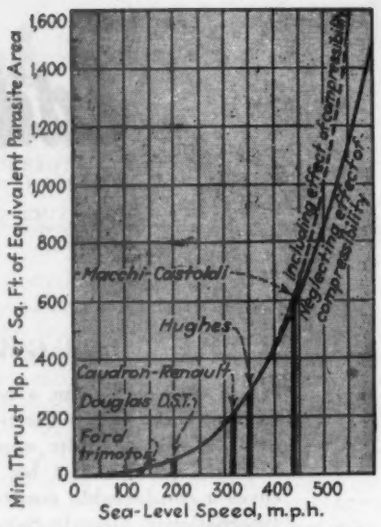
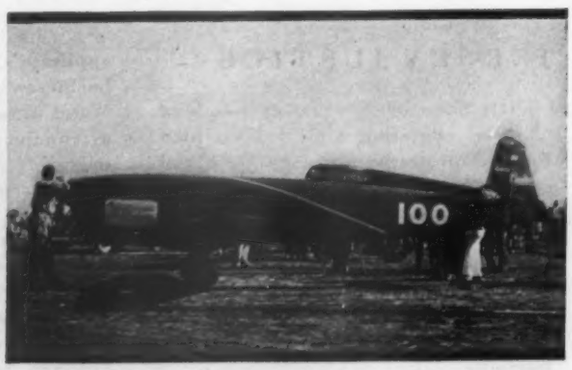


Fig. 2. "Cost" of Airplane Speed in Terms of Power and Cleanness.

The Hughes Racer, holder of world's landplane speed record. The landing gear is of the retractable type and the engine is, of course, completely cowled.



The Caudron-Renault racer, holder of the Thompson Trophy speed record, and former holder of the world's landplane speed record.

Editorials

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VOLUME 35, NUMBER 11

HOME THOUGHTS FROM ABROAD

▶ The title may seem a bit premature as this is being written in New York, but by the time this issue of AVIATION goes into print it will be quite appropriate, for your editor will be in England on the first leg of an aeronautical cruise that will cover a considerable portion of Europe and will wind up at the International Aircraft Salon in Paris, late in November.

No junket this, but a part of a long-established program of world wide coverage. AVIATION has never operated on a stay-at-home, paste-pot-and-scissor basis. It has always taken every opportunity to get out and see for itself. Even through the depth of depression, when expenses had to be cut to the bone, the editorial staff was travelling, visiting factories, maintenance shops and airports. In the last two years they have logged over 50,000 miles, up and down the country's airways, from the Atlantic to the Pacific, and from Canada to Panama.

So once more we are turning our personal attention to Europe. It is not a new idea, for our distinguished predecessor made several trips abroad during his editorship of AVIATION. His wide acquaintance with people and affairs outside of the United States have been invaluable to the proper conduct of this magazine in recent years.

At this time we hope to consolidate our own contacts in Europe, and to bring back to the readers of AVIATION a firsthand picture of European aviation today. This is especially important at this time when commercial services of all countries are extending themselves to encircle the globe, and when the uncertain political state of Europe is reflected in development and construction of military aircraft on an unprecedented scale.

In carrying out a program of this sort we are but continuing the policies laid down by the founder of AVIATION twenty years ago. He saw then that the interests of the magazine were international in scope—that aviation people all over the world had a common interest that transcended national boundaries. Our purpose is to carry on with that idea, to report without fear or favor,—without malice and without political bias,—events and material of interest to the aviation industry all over the world.

JERSEY JUSTICE

THE State of New Jersey has long been operating a neat little plan for the protection of legitimate and qualified fixed base operators that may well be made a part of other state aviation programs. Before anyone can move into any New Jersey airport and set up in the flying business, he must receive the approval of Gill Robb Wilson's Aviation Commission.

And the granting of the approval is no mere red-tape formality. The applicant's history, both personal and business is thoroughly investigated. Moral integrity carries as much weight as financial responsibility, and his operating plan also is subjected to the closest scrutiny. Not only must his equipment be of approved type, but the airport and its surroundings must meet all state requirements for size and surface conditions and have safe approaches.

Once he has been passed upon, however, he may set up his business with the assurance that no irresponsible operator will be permitted to settle down in his territory to chisel into his profits by skimming the cream of the seasonal business and then moving on. This in itself is a great contribution to safety, for the operator can then spend his money for good equipment and for adequate maintenance, with full assurance that his rights will be protected.

The removal of unrestricted cut-throat competition through this form of state control has undobutedly contributed greatly to New Jersey's excellent safety record of the past few years.

HAIL AND FAREWELL

DEPARTING from Lakehurst on a night that kept all other forms of aircraft grounded, the Zeppelin Hindenburg completed the last of the announced schedule of ten round-trip flights between Germany and the United States for the 1936 season. Few aeronautical projects of such proportion have ever turned their promise into performance as has this season's operation of the Zeppelin Reederei. Those of us who have watched her regular comings and goings could not fail to be impressed with the efficiency and dispatch which have surrounded her visits. Those who have had the good fortune to travel on the Hindenburg have been loud in their praise of airship travel. The only complaint which has reached us has concerned the general lack of excitement connected with the trips.

There is no question but that considerable public interest has again been aroused in the possibilities of lighter-than-air travel. We cannot help but feel that this summer's work has done a great deal to offset the effects of the unfortunate experiences of the past. A straw in the wind is Col. J. Monroe Johnson's announcement that he is preparing an amendment to the Maritime Act to extend to airships the same financial support provided for surface craft. This covers two major features, (1) a guaranty that a dirigible would cost the United States only the cost of a similar ship built in a foreign country, and (2) any differential in the cost of operating an airship as compared with the operating costs of any foreign company would be met by the U. S. government.

We look forward confidently to a re-birth of sufficient interest in airships in the United States to lead to the establishment of a sound program for commercial lighter-than-air development under our own flag.

Flying Equipment

What's new in aircraft, engines and major accessories

Roadable Autogiro

Jim Ray delivers new machine by landing in park and driving up to Commerce Department door

LANDING on roofs or in city streets is something most pilots do once in a lifetime but to James G. Ray, vice-president of the Autogiro Company of America, it is commonplace. Jim's most recent venture was the delivery of the new "roadable" autogiro at the front door of the Commerce Building in Washington. Although the roadable giro is designed to be driven home from the airport, Pilot Ray didn't follow this formula at Washington. Instead he landed in a small downtown park near the Commerce Building, folded his rotors and drove to his destination. Delivery was made formally in the presence of Air Commerce Director Eugene L. Vidal, Secretary Daniel C. Roper and Col. J. Monroe Johnson, Assistant Secretary of Commerce. Passenger on the flight to Washington was John H. Geisse, Chief of the Development Section of the Bureau. Following the delivery a series of acceptance tests were scheduled at Bolling Field.

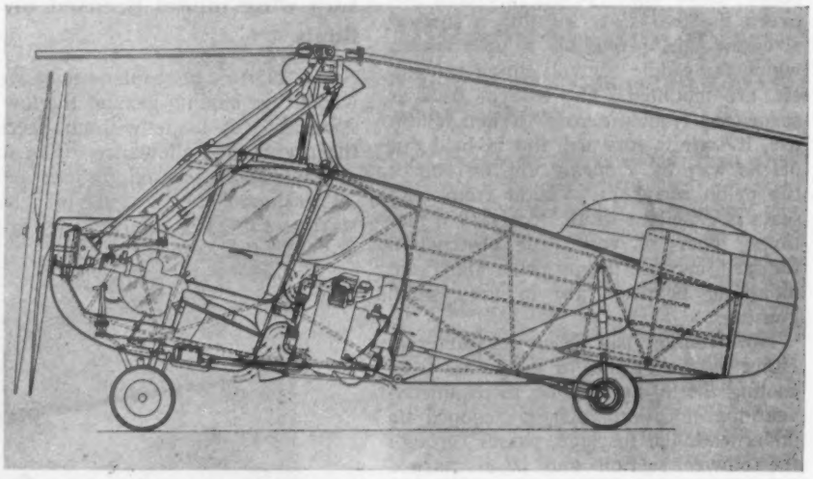
Designed to combat the handicap of inaccessibility of airports from centers of population, the new giro is distinguished from its predecessors chiefly by the roadability feature. This demanded a change from the conventional engine location to provide for the transmission of power to the rear wheel, which is the driving wheel on the road. The location selected for the engine was behind the cockpit with one drive shaft running back to the rear wheel and another running forward, through the cockpit to a gear box which transmits power to the tractor propellers and to the rotor hub for starting.

Several times in the last year we have stopped in at Willow Grove, to watch progress on construction of this ship. So we have seen it both dressed and undressed as it were. The accompanying drawing gives a good idea of its internal arrangement. In preparing the drawing of the photograph, however, it is obvious that some changes have been made in recent months.

Most apparent is around the nose where the double propeller combination has been abandoned in favor of a single airscrew. The combination did not give the desired results as far as torque elimination is concerned, and besides made a terrific clatter in flight. This last is attributed to the greatly disturbed air flow between the two propellers. When the combination was replaced by the single prop the nose shape was modified considerably, the older rounded and very blunt lines were considerably modified to a more pointed form, which we understand has improved the speed characteristic considerably.

By making closer comparisons also, it will be noted that the tail surfaces have been modified. The first form was of a completely cellular type. When the ship was delivered, however, a monoplane stabilizer, a normal fin, a small rudder and sloping end plates appeared.

The fuselage and the struts making up the rotor pylon are of welded steel tubes. An interesting feature of the landing gear is the stearable front wheels. Each wheel is mounted on a swiveling knuckle, somewhat similar to ordinary automobile front wheel mountings. By means of cables and tie-rods, the wheels are hooked up to the rudder pedals.



The Roadable Autogiro in its earlier stage.

Landing in a Washington park.

Driving in traffic.

With this combination, the ship is said to be very maneuverable on the ground.

One gets an impression of extremely small size when first looking at the machine, but after entering the cabin, one finds plenty of room, comparable to the average small closed airplane. The propeller drive shaft passes forward between the two seats forming a sort of arm-rest and providing a pedestal on which the saddle control, clutch control, etc. are mounted. The control stick is suspended from the roof. When not in use, it swings forward and is held out of the way by a spring clip on one of the pylon members. Vision from both seats is excellent in all necessary directions. There is very little obstruction forward, because the propeller shaft and mounting bearings are in very small housings.

No trouble has been encountered, either on the ground or in the air from cooling the 90 hp. Pobjoy in its unconventional location. Air is scooped up underneath the fuselage, passes through the blower section and is discharged through sets of louvres along the fuselage side.

The roadable giro has a top speed of 90 m.p.h. and sufficient fuel and oil are carried for 3½ hr. cruising flight with pilot, one passenger and 40 lb. of baggage. Minimum speed is 20 m.p.h. and it is designed to take off in less than 150 ft. with no wind. Additional performance data will be released following the test flights.

Aeroneer Tested

Production of 25 Ships to Follow Completion of Flights

FIRST "Aeroneer" is dedicated to the Gilmore lion. Flight and performance testing is now being completed. Production of a group of 25 of these ships is scheduled to be started in the near future.

Daily flights of the first Aeroneer were made during the National Air Races and much favorable comment was received by the manufacturers.

Aeronca Seaplane

Low wing model licensed on Edo floats

SUBSTITUTION of seaplane floats for the wheel type landing gear of the low wing Aeronca was made without decreasing the useful load allowance. The ship as a seaplane is licensed for two persons, 28 gal. gasoline, 3 gal. oil; battery, starter, and 75 lb. of baggage, bringing the gross weight up to 1,852 lb. Test flights of the new seaplane were made recently by J. C. Welsch, sales manager of the Aeronautical Corporation of America, at the plant of the Edo Aircraft Corporation whose model 1965 streamline floats are used. The engine is the 90 hp. Warner.

"Time Flies"

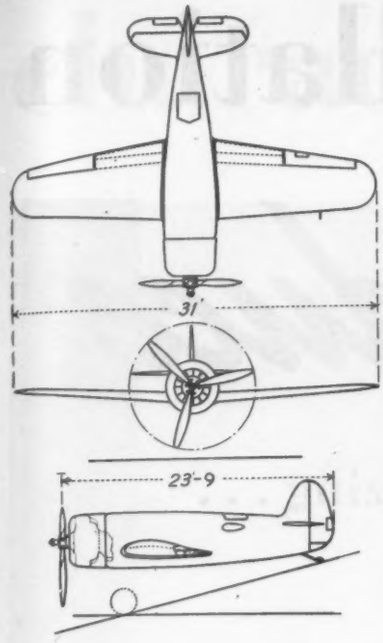
Tests underway on Frank Hawk's Monoplane

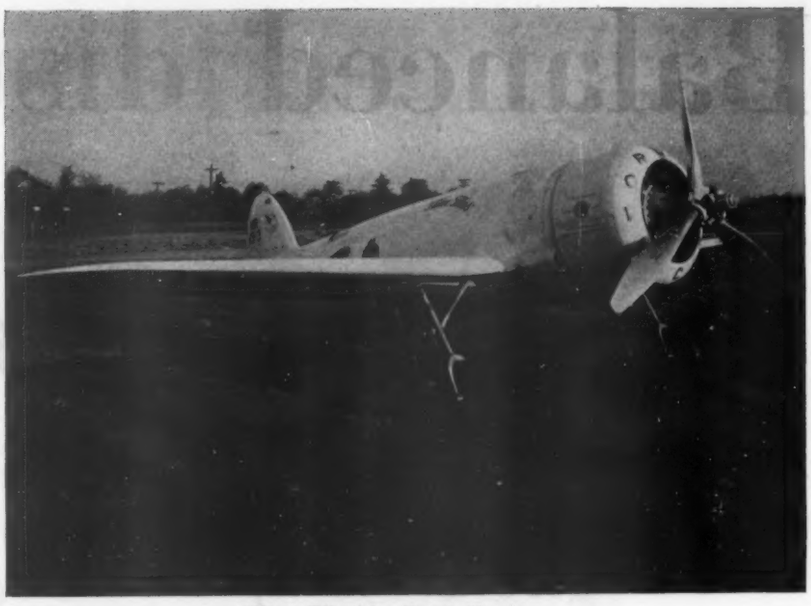
PRELIMINARY details of Frank Hawks' new plane, "Time Flies" were published in the October issue of AVIATION. At that time there was no pictorial material available. We are now able to present photographs and three view drawings of the ship that is expected to break many records. During the construction of the new ship, Hawks has lived with the job and he is now putting the plane through its paces in flight in an equally serious manner.

Details of the structure, retractable cockpit enclosure, and other design features were discussed in the previous article in AVIATION. Unusual features of the accessory equipment include the installation of the new Sperry gyromagnetic compass, a combination of the gyro and magnetic compasses. A Breeze exhaust gas analyzer is also installed on the ship. In addition to the complete radio equipment, an ultra high frequency transmitter and receiver (1-5 meter band) has been built into the ship.

Streamline floats make low wing Aeronca a seaplane.

Menasco powered Aeroneer in flight.





"Time Flies" by Frank Hawks

Lycoming powered Stearman primary trainer.

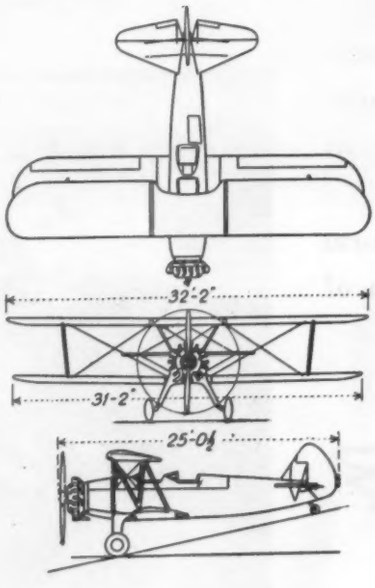
The engine is an R-1830 BG Twin Wasp developing 1150 hp. at sea level, equipped with automatic mixture control. A Hamilton-Standard constant speed propeller is used.

Stearman PT-13

Model 75 use by Army as primary trainer

For primary training at Randolph Field extensive use is made of the PT-13, Stearman Model 75 biplane powered with the Lycoming R-680-5 engine. The PT-13 is a two place tandem open ship with wooden wings, welded chrome molybdenum steel tube fuselage, and fabric covering. Tail surfaces are similar in construction to the fuselage.

Wing span of the PT-13 is 32 ft. 2 in.; overall length, 25 ft., ½ in.; weight empty, 1,880 lb.; and gross weight, 2,589 lb. High speed at sea level is 125 m.p.h.; cruising speed (sea level), 103 m.p.h.; service ceiling 14,000 ft.; and cruising range, 412 miles.



Mitsubishi Monoplane

Two designs by Japanese Government Railways

The Japanese Government Railways has designed two airplanes equipped with all the necessary instruments for surveying and emergency purposes. Both are single engine high-wing monoplanes. One of them, built by Mitsubishi, was remodelled from the Army's "92" type reconnoitering plane, which is equipped with a 475-hp. Mitsubishi Jaguar air-cooled radial engine developing 400 b.h.p. at 2,000 r.p.m. Weight empty is 1,060 kg. (2,332 lb.) and gross weight is 1,900 kg. (4,180 lb.), exclusive of armament equipment. The plane has the following general dimensions:

Wing span 12,700 mm. (41 ft. 8 in.); length overall 8,515 mm. (28 ft.); wing area 26 sq.m. (280 sq.ft.).

According to the "Koku Jidai," the machine is capable of a normal level flying speed of about 190 km. per hour (118 m.p.h.) a top level speed of 210 km. per hour (130 m.p.h.) and can climb to a ceiling of 6,000 m. (19,580 ft.). The "Kogyo Zasshi" reports that it develops a top speed of 220 km. per hour (136 m.p.h.) at an altitude of 1,000 m. (3,280 ft.) and 312 km. per hour (193 m.p.h.) at 3,000 m. (9,840 ft.). Both agree that its cruising range is 900 km. (558 miles).

The other monoplane, which is still in the course of construction, has been remodelled from the "95-2" type training plane of the Imperial army, which

(*Turn to page 39*)

Balanced distillation

reduce

Lower temperatures . . . without freezing . . .

give greater power output

YOU can lower the temperature of your "hot spot" and still reduce the possibility of icing.

This exceptional performance is only possible when the distillation temperatures at 10%, 50% and 90% of the volume are held to exacting limits and bear a definite ratio to each other. Because Texaco has access to all types of crudes, Texaco refiners select only those crudes that have the necessary characteristics to maintain this balance.

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Right: Testing gasoline for distillation characteristics. Texaco Aviation Gasoline is processed by special refining methods. We can control the distillation curve to very narrow limits.

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→ VISIT THE TEXACO EXHIBIT—POWER SHOW—GRAND CENTRAL PALACE, N. Y., NOV. 30th to DEC. 5th—BOOTH 282

85,000 lb. psi. Min. Yield Point

MOST AIRCRAFT MEMBERS are critical in compression. Tests have definitely shown a safe allowable load for short columns in compression lies in the region of the tensile yield point.

Recent tests by SUMMERILL indicate that we can guarantee to aircraft manufacturers a minimum yield point of 85,000 lb. psi for normalized Chrome Moly tubing, $\frac{3}{16}$" wall and lighter, and still maintain the elongation required by Army and Navy specifications.

The Bureau of Air Commerce summarizes its position with respect to high yield points by saying:—

"If the yield point in question is guaranteed as minimum by the tubing manufacturer, it will be satisfactory to use it in conjunction with the conventional Johnson (parabolic) formulas for short columns, provided that the guaranteed yield point is definitely specified on all drawings to which it applies".

SUMMERILL TUBING COMPANY
SPECIALISTS IN TUBING SPECIALTIES
BRIDGEPORT, MONTG. CO., PENNSYLVANIA

is incidentally the type adopted for commercial aviation by the Nippon Aircraft Company. According to the official publication, the original machine is equipped with a Nakajima-Jupiter air-cooled radial engine, which develops 450 b.h.p. Having full flight load, it is capable of climbing up to 6,000 m. (19,680 ft.) and has a level flying speed of 250 km. per hour (155 m.p.h.).

Model "90" Japanese survey plane.

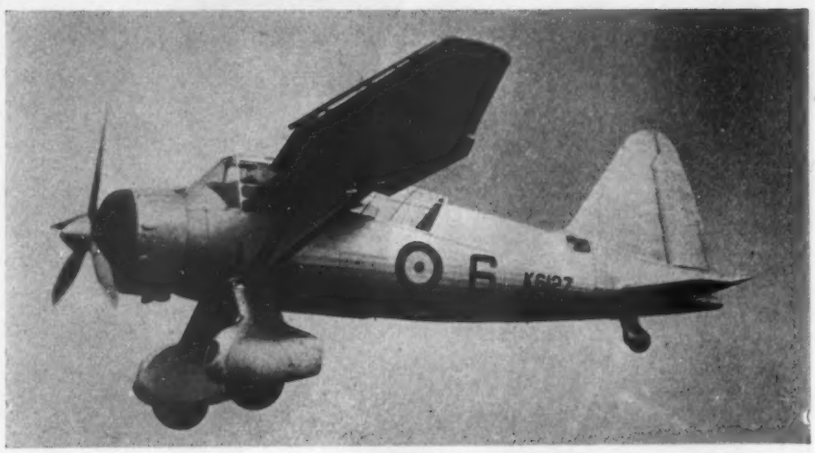
Westland Monoplane

Army Cooperation ship has high performance

THE relatively recent trend toward streamlining and aerodynamic cleanness of British military planes is well reflected in the new Westland Army Cooperation plane which made its debut at the Royal Air Force Display last summer. Subsequent test flights during the display of the Society of British Aircraft Constructors indicated that the new ship's performance exceeded that of earlier planes of this type. The actual figures have not yet been released.

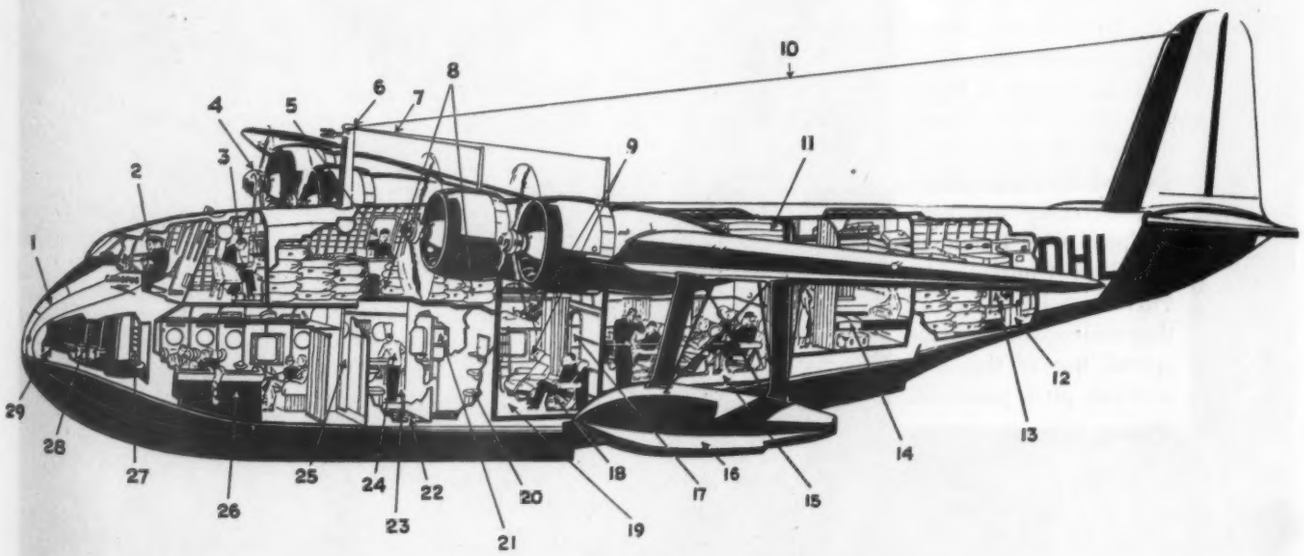
The new ship, a high wing, strut braced, monoplane is powered by the Bristol Mercury radial engine or the Perseus VIII sleeve valve model which has a maximum output of 810 hp. at 5,250 ft. A controllable pitch, three-bladed propeller is standard equipment.

Essential to the effectiveness of army cooperation planes is the ability to operate from improvised landing areas near the front. To provide this type of performance, Handley Page automatic wing slots and flaps are fitted to the highly tapered wing.



The Westland army cooperation plane.

Cabin plane comfort is provided in the separate enclosed cockpits for pilot and observer. Both compartments are roomy and are fitted with controllable heating apparatus. Vision from both positions is superior to that of earlier ships of this type. The wing span is 50 ft. and the overall length, 30 ft.

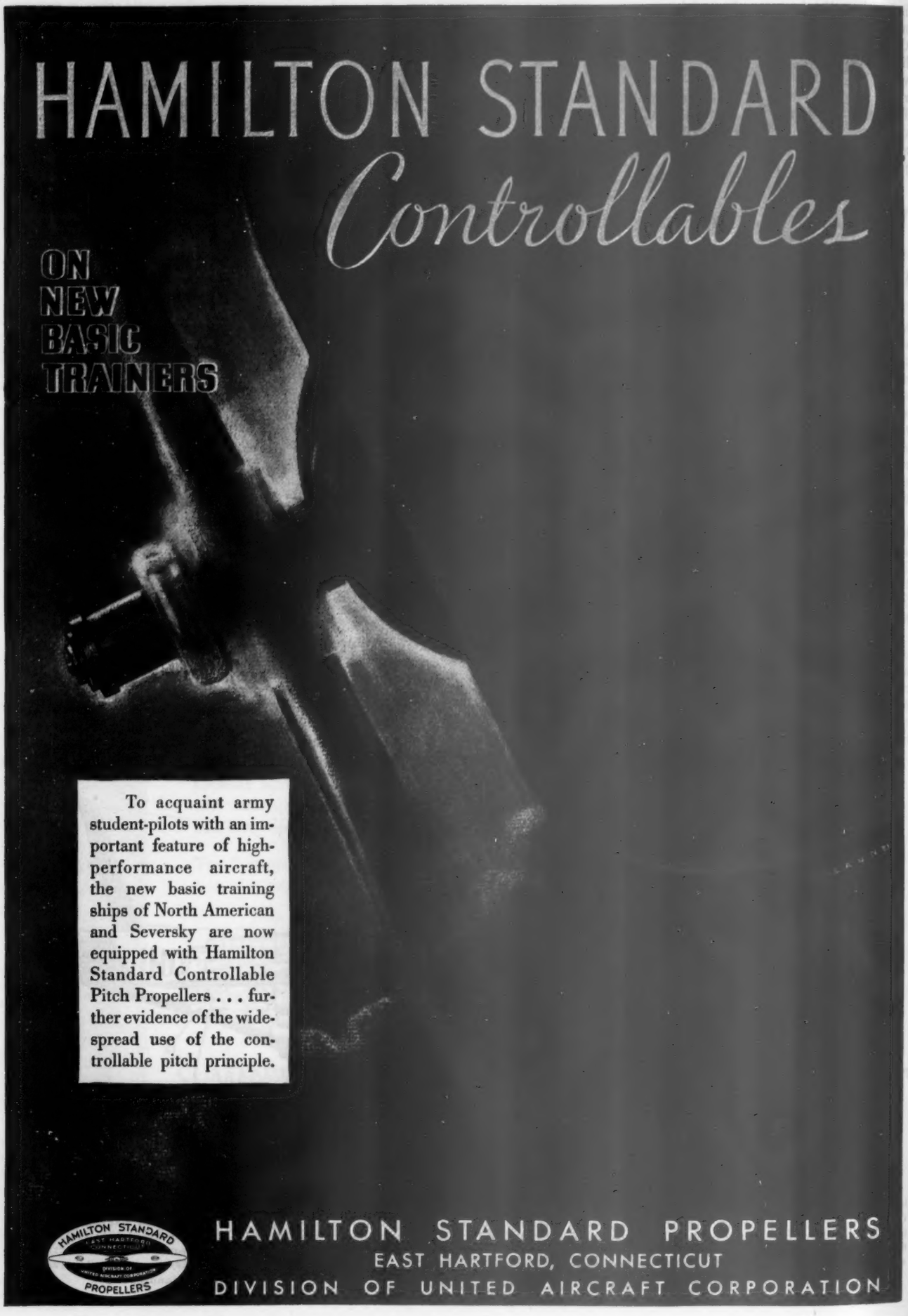


SHORT EMPIRE "CANOPUS"

in section. (1) Mooring hatch; (2) pilots' compartment; (3) radio operator; (4) rotable loop antenna; (5) ship's clerk; (6) mast head light; (7) vee aerial; (8) mail compartments; (9) sleeping berths; (10) fixed aerial; (11) hold for bedding; (12) mail and baggage hold; (13) trailing edge flaps; (14) after cabin (six day passengers, four at night); (15) promenade cabin (eight by day, four by night); (16) wing tip float; (17) main gangway; (18) adjustable chairs; (19) mid-ship cabin (three by day, four by night); (20) women's lavatory; (21) gangway to upper deck; (22) men's lavatory; (23) kitchen; (24) steward; (25) passageway from main entrance; (26) smoking cabin (seven by day, four by night); (27) gangway to control room; (28) mooring compartment; (29) retractable landing light.

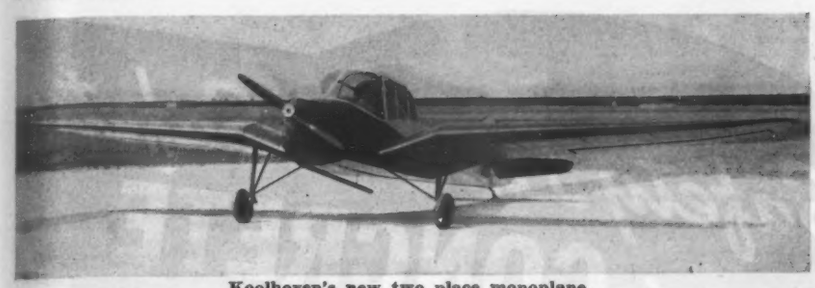
HAMILTON STANDARD *Controllables*

ON NEW BASIC TRAINERS



To acquaint army student-pilots with an important feature of high-performance aircraft, the new basic training ships of North American and Seversky are now equipped with Hamilton Standard Controllable Pitch Propellers . . . further evidence of the widespread use of the controllable pitch principle.

HAMILTON STANDARD PROPELLERS
EAST HARTFORD, CONNECTICUT
DIVISION OF UNITED AIRCRAFT CORPORATION



Koolhoven's new two place monoplane.

Koolhoven-Junior

Two place all wood monoplane has clean lines

A CLEAN LOOKING two place cabin monoplane has just been introduced by Koolhoven in The Netherlands. The Junior (Model F.K. 53) is somewhat unusual in appearance in that the main wing panels are located at about one half the height of the fuselage and connected by short stub wings to the lower longeron giving a pronounced gull effect. This arrangement combines the desirable weight distribution of a center wing monoplane with the good visibility of the low wing type.

Wood construction is used for the most part. The wing is built up of two spars and three ply ribs, the stubs being integral with the fuselage which is made up of three ply with spruce longerons. Outer wing panels are easily detachable from the central unit. Plywood is used principally for the covering of wing and fuselage. The tail unit is of construction similar to the fuselage and is integral with it.

Landing gear consists of two separate units bolted to the wing stubs. Rubber blocks in compression constitute the shock absorbers.

The power plant is a 50 hp. Walter Micron and the engine mounting is of welded steel tubing.

Wing span of the F.R. 53 is 10.5 m. (34.5 ft.); length, 7.2 m. (23.6 ft.); and area, 15.5 sq. m. (167 sq. ft.). Weight empty is 275 kg. (605 lb.) and gross weight, 480 kg. (1,056 lb.). Maximum speed is 150 km. per hour (93 m.p.h.); cruising speed, 125 km. per hour (78 m.p.h.) (both at sea level) and landing speed is 60 km. per hour (37 m.p.h.). Service ceiling is 2,800 m. (9,184 ft.) and range varies from 375 km. (233 miles) to 1,320 km. (818 miles).

Breda 79, 79S

Two new Italian ships for private flying

A NEW SHIP for private flying and touring has just been introduced in Italy by Breda. Two models—the 79 with three seats and the 79S with four seats, are available. The former is powered by the 110-130 hp. Alfa Romeo engine while the latter uses a 115-200 hp. power plant of the same make. Both of the engines used are inverted, in line types.

Structurally the Breda 79 and 79S are similar. Both have wooden wings with plywood and fabric covering, metal fuselages with fabric and aluminum alloy covering and metal tail surfaces with fabric covering.

Dimensions for both models are: wing span, 11.61 m. (38 ft.); length, 7.60 m. (25 ft.); height, 1.97 m. (6.5 ft.); wing area, 18 sq. m. (194 sq. ft.). Maximum speeds are: (79), 210 km. per hour (130 m.p.h.); (79S), 260 km. per hour (161 m.p.h.). Minimum speeds are: (79), 70 km. per hour (44 m.p.h.); (79S), 75 km. per hour (47 m.p.h.). Range of the 79 is 700-1,500 km. (434-930 mi.) and for the 79S is 700-1,200 km. (434-744 mi.).

Dornier Do 22

New three seat bomber and reconnaissance seaplane

A LIGHT BOMBER, torpedo bomber, or long distance reconnaissance plane, the Do 22, has just been released by the Dornier Works of Friedrichshafen, Germany. Accommodations for three —a pilot, observer, and gunner, are provided in the metal fuselage of this twin float seaplane. The oval section fuselage is built up of welded steel tubing with duraluminum bulkheads. Sheet metal and fabric covering are used. The wing structure is of duraluminum with fabric covering. Tail surfaces are of duraluminum with fabric covering. Compensation is obtained by small auxiliary surfaces above the stabilizer.

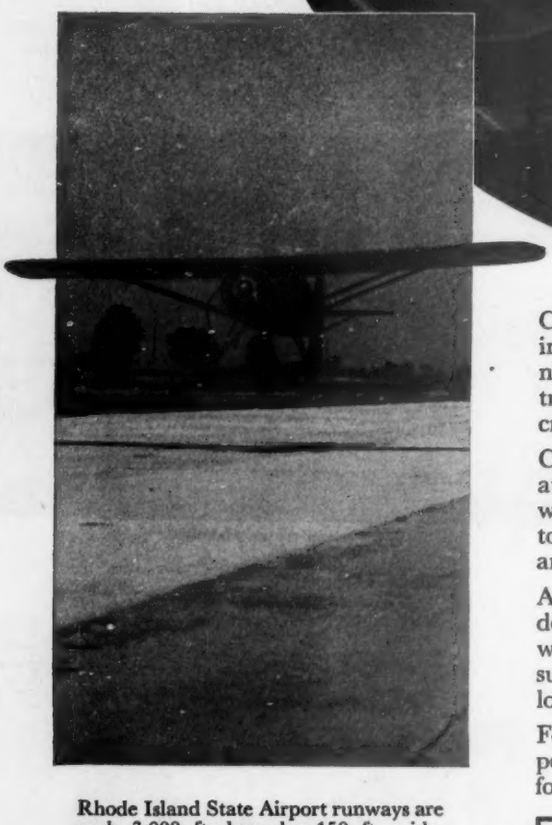
Various engines ranging from 700-900 hp. can be used. The model shown here is powered by an 860 hp. Hispano-Suiza, twelve-cylinder engine.

Span of the Do 22 is, 16.2 m. (58.1 ft.); overall length, 13 m. (42.7 ft.); overall height, 4.7 m. (15.4 ft.) and wing area, 45 sq. m. (484 sq. ft.). Weight empty is 2,328 kg. (5,122 lb.) and normal gross weight, 3,550 kg. (7,810 lb.); maximum gross weight, 4,000 kg. (8,800 lb.). Maximum speed is 320 km. per hour (198 m.p.h.); landing speed, 82 km. per hour (51 m.p.h.); ceiling is 9,200 m. (30,176 ft.).

Do 22 with 860 hp. Hispano Suiza engine.

Breda Model 79 with Alfa Romeo engine.

Take off in Safety Land in Safety on runways of CONCRETE



Rhode Island State Airport runways are each 3,000 ft. long by 150 ft. wide. Pavement consists of five 30-ft. sections each of 8-6-8-in. cross section, divided into 10-ft. lanes. (Upper view.)

The first takeoff from the new Dayton Municipal Airport at Vandalia, Ohio. Project financed by WPA funds.

Concrete's safety reaches out miles from the airport to the incoming plane. For pilots can see light colored concrete runways night or day. And when the plane settles down it has a smooth track to land on with ample traction for tires—no excessive crown, no puddles of standing water, no ruts or bumps.

Concrete's cleanliness and safety improve ground facilities; help attract business to any airport. Concrete is serviced in good weather or bad, shortens takeoff runs, is free from loose particles to be picked up by the propeller stream, endangering passengers and planes.

And the cost? Surprisingly low. For concrete runways can be designed economically for given wheel loads and landing impacts with ample safety factors. Concrete stands up under heavy loads; supplements its moderate first cost with long life and extremely low maintenance charges.

For safety, for service and for ultimate economy, your city's new airport should be concrete. Let us help you plan it by sending free Information Sheets and the booklet, "*Concrete Makes a Modern Airport.*"

PORTLAND CEMENT ASSOCIATION
Dept. A-11-41, 33 W. Grand Ave., Chicago, Ill.

Please send me Information Sheets and "Concrete Makes a Modern Airport."

Name .....

Address .....

City ..... *State* .....

Buyers' Log Book

What's New in Accessories, Materials, Supplies, and Equipment

Curtiss Pneumatic's hoist.

Hydraulic Hoist

Elevators have a number of aeronautical applications

AIR OPERATED hydraulic hoists of the type found in many garages, have been applied to a number of aviation activities (see Maintenance Notebook). A complete line of equipment of this sort, is manufactured by the Curtiss Pneumatic Machinery Company of St. Louis, Mo. These elevators are of the plunger type, operated either by air pressure above the oil in a separate reservoir or directly by pressure developed by an electrically driven oil pump. The operating cylinders are designed to be set vertically into the ground. A wide variety of piston designs is available for specific applications.

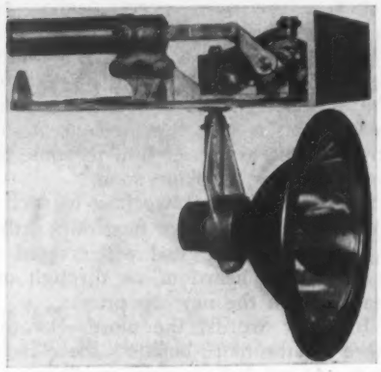
Retractable Light

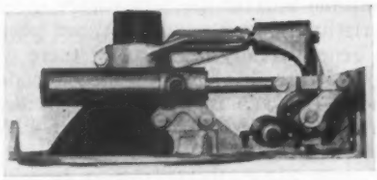
Delco announces hydraulic retractable landing lights

A NEW SERIES of landing lights for aircraft has been designed and is introduced by Delco, Hartwell Building, Long Beach, Cal. Air Associates is handling sales on this equipment.

The Delco light is designed to lie flush with the under surface of an airplane wing when not in use. When extended hydraulically, it moves through an arc of 90 deg. downward and forward. The light is hydraulically operated from a small control box in the cockpit through a single line of flexible tubing. A ratchet arrangement permits the light to be adjusted at any one of fifteen intermediate angles. The pair of lights and the control box with 7 in. reflectors (625,000 candlepower) weigh approximately 9½ lb.

To meet transport requirements, a new light with a 17-in. diameter reflector, designed to be mounted in the under part of an airplane fuselage is being developed.





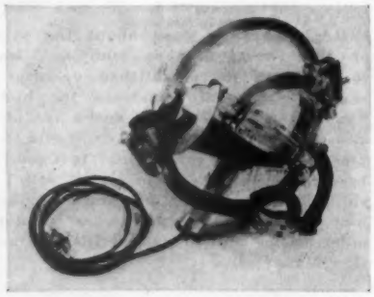
The new Delco light extended and retracted.

Position Finder

New instrument developed by Fairchild for navigation calculations

THE HAGNER Position Finder is the latest in navigation equipment developed by the Fairchild Aerial Camera Corporation of Woodside, L. I., N. Y. It is substantially a slide rule sextant which permits obtaining a "fix" in a much shorter time than with the standard equipment. The primary purpose is to eliminate much of the complicated computations necessary in the usual method of position determination.

It is a compact instrument of high precision which may be considered a miniature celestial sphere. It consists principally of a horizon plane, declination arc, latitude arc, altitude arc and hour angle circle. The horizon plane carries the altitude arc, azimuth circle and a circle level bubble. With the instrument an observer needs only the nautical almanac and a clock giving Greenwich civil time. It may be hand-held for an observation or it may be placed in a gimbal. The instrument was invented by Mr. Fred C. Hagner of San Antonio, Texas.



The Fairchild-Hagner Position Finder.

Aircraft Skiis

Snow equipment designed for light plane service

ANNOUNCEMENT has been received from Air Transport Equipment, Inc., of Roosevelt Field, Garden City, N. Y., of new snow equipment, designed particularly for airplanes of the Taylor Cub, or Aeronca class. They are made of oak reinforced with brass runners. The attachment pedestal is made of chrome-molybdenum welded steel tubing fitted over the regular wheel axles of the airplane on graphited bronze bushings.

The Model A skiis are manufactured under Bureau of Air Commerce approved type certificate No. 66 for airplanes whose gross weight does not exceed 970 lb.

Air Transport equipment Model A Skiis on a Taylor Cub.

Operators' Corner

An exchange of ideas on the problems of the commercial aviation industry

WHAT is to be done about the problem of the young student who has learned to fly with an established operator and wants to go into business for himself? Should the parent school encourage him by assistance of various kinds, or should it treat him as a possible competitor? Is it good business in the long run to try to sell him a ship, find an airport for him and instruct him in operating methods, or should the older school confine its activities to instruction alone?

Helps plane sales

EVERY student pilot is a potential future member of commercial aviation in one or several ramifications. All flying school operators are conscious of this fact and many feature their ability to place the student pilot when he becomes qualified for such work. It is obvious that a small proportion of student pilots only look upon commercial aviation as a probable vocation, many learning to fly for private purposes or recreation only. It is my belief that the flying school should not regard potential operators developing from student pilots as competitors as it is inevitable that this field will expand and develop.

It would appear good salesmanship on the part of a flying school to attract prospective students by offering the service of assisting them to become established as operators when they are qualified. Profits from plane sales activity is a considerable factor in flying school receipts and should be encouraged. I feel that the benefits to the flying schools following this practice more than offset the value of the effort expended.—EDWARD A. DYCER, *Dycer Flying Service, Inc., Dycer Airport, Los Angeles, Cal.*

Newcomers not competitors

THIS question is right up our alley. We have made a special study of it and acted accordingly. First we do not view a newcomer as a competitor but as a welcome brother in the fraternity.

Over a period of years we have accumulated a wealth of information on just how to help a new operator get started in the aviation business. If he is a student of ours he has ample opportunity while learning to fly to learn our methods of merchandising and operating. Then when he starts an airport he knows just what to do and how to do it. We not only show him but give him actual practice in selling airplanes, flying courses, and passenger flights; the proper way to instruct students in order to make them good, safe pilots; how to maintain equipment and to operate efficiently; how to utilize every valuable moment that so many operators let slip away; how to write advertising and get inexpensive but valuable publicity and a score of other things, the combination of which is bound to make anyone successful in aviation.

We have helped several young fellows get started this year and we have more places to put new operators than we have operators to put in them. Six weeks ago we sold a fellow a new airplane and arranged for an airport for him to operate. Last Friday he came back for his second new airplane and he now tells us to expect him to come for his third new airplane soon.

For every student we lose to such a competitor we get two new ones either as a result of the good will created or because they heard of us through our dealing with the new operator.

In other words, the more operators there are the more business there is for each one. I believe this condition will continue because the very nature of airports limits their number. When people in general really begin to fly there will not be enough airports to accommodate them.—ALFRED B. BENNETT, *President, Bennett Air Service, Central Jersey Airport, Hightstown, N. J.*

Should be discouraged

I AM not at all in accord with the barnstorming ideas now so prevalent that newly licensed students be encouraged and allowed to open up when and where they will and start selling instruction in competition with established schools. We have a lot of it throughout the country today and it is actually becoming a menace to the welfare of aviation, not because of the sometimes unjust competition, but because of the thrill-seeking youngster who has learned to fly himself and is all too often imbued with the wrong sort of enthusiasm.

I believe that a student who has gained the proper license, and whom the established operator knows to be anticipating a venture of his own in attempting to start a school, should be deterred from the idea with a serious heart-to-heart talk about the necessary experience needed by the instructor and about the duties of a school to the public.

It is my opinion that the Department of Commerce should realize the fallacy of the newly licensed student attempting to instruct, and should make it compulsory for him to have a minimum of at least 500 hours before so doing.

A flying school should be a very serious business enterprise, unactuated by negative enthusiasm or the objects of the usual newly graduated young pilot, for as a rule, the young pilot has no capital himself, and is prompted to promote his equipment and, fired by the necessity of immediate finances, is inclined to cut prices, indulge in bad business tactics, and do almost anything contrary not only to the principles of good business but to the progress of aviation.

I therefore believe that it is not good business for the parent school to encourage his entrance into aviation instruction, or to sell him a ship for that purpose, for in the long run it usually acts as a boomerang.—*Karl E. Voelter, Inc., All American Airport, Miami, Fla.*

"Work" students' ships

THE young student who wants to go into business for himself has not been much of a problem with us. We believe the prospective customer fully appreciates the fact that his flight training should be under the guidance of experienced instructors and will not be apt to patronize someone who has just recently obtained his transport license. It is possible for the young, new operator to do some rental business, but his inexperience in the management of such a business and the tendency of students and pilots to patronize other operators who have an established reputation will not enable him to offer serious competition. We take care of this problem by trying to sell the student a ship, and if he cares to make some money out of it, we "work" it for him collecting a reasonable commission on the income for furnishing him with customers and handling the transactions.—GEORGE A. VIEHMANN, *Manager, Standard Flying Service, Inc., Somerset Hills Airport, Basking Ridge, New Jersey.*

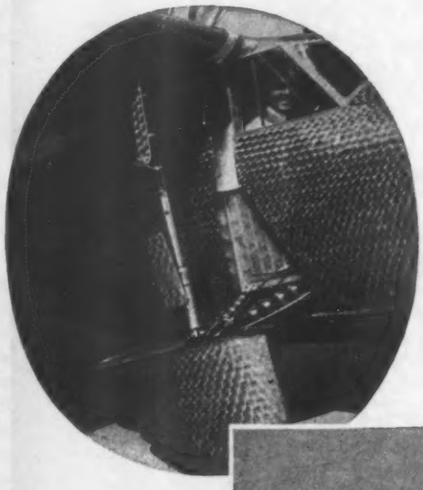
Question 19

(Answers to be published in December)

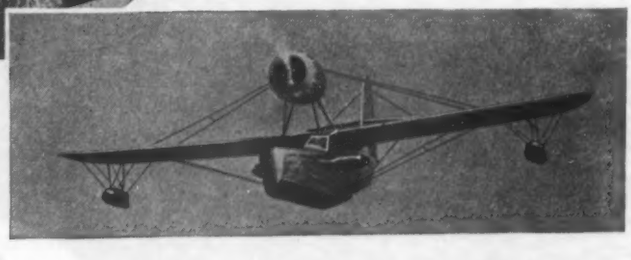
WHAT method do you employ to insure competition of charter service within the time agreed upon between yourself and your prospect? How do you compute the necessary leeway between the promised arrival time and the cruising speed of the airplane? Do you hold standby equipment ready to overtake your ships if they are forced down by mechanical trouble?

LIGHTER and STRONGER-
FASTER and SAFER . . .
FLEETWINGS "SEA BIRD" AMPHIBIAN
Stronger . . . and lighter by 200 lbs! Faster . . . and safer . . . permanently immune to corrosion . . . fire resistant up to 2000° F. The Sea Bird's designer, Mr. Carl de Ganahl, achieved these improvements by specifying U S S Stainless Steel for practically every part except motor and wing covers.

thanks to U·S·S STAINLESS STEEL



Notice in these two views the interesting detail of the retracting landing gear. Notice also the exceptionally smooth, neat, rivet-less construction made possible by "Shotweld" fabricated U S S Stainless Steel. The metal surfaces need neither paint nor varnish.



IT'S U S S Stainless Steel that makes the Fleetwings "Sea Bird" Amphibian lighter and at the same time stronger; faster and at the same time safer. The explanation? Just two simple facts . . .

Of all metals available for airplane construction, stainless steel has by far the greatest strength-weight ratio. And of these metals, only stainless steel is truly corrosion-resistant—so truly corrosion-resistant that coatings or "clad"ings are never needed, that tarnish can never dim its brilliant surface.

Example: Since there can be no loss of metal by corrosion, the designer is free to use thinner sections extending further from their neutral axes . . . and these sections can be *closed*. Result: Light weight sections of tremendous strength.

Important, too, is the "Shotweld" process of stainless steel construction. Hull, fuselage and wing structure are made virtually one strong homogeneous metal unit. And with no rivet heads to interrupt the airstream, skin friction drops to a minimum.

Unquestionably, stainless steel is an ideal metal for airplane construction. To airplane designers and operators, it offers inviting, challenging opportunities to build new planes lighter *and* stronger; faster *and* safer.

For further information on the Sea Bird write Fleetwings, Inc., Bristol, Pa.; on the "Shotweld" process, write Edw. G. Budd Mfg. Co., Philadelphia, Pa.; on the properties and opportunities offered by U S S Stainless Steel, address the stainless steel specialist in our nearest district office.

U·S·S STAINLESS STEEL

AMERICAN STEEL & WIRE COMPANY, *Chicago and New York*
CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
NATIONAL TUBE COMPANY, *Pittsburgh*

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* · United States Steel Products Company, New York, *Export Distributors*

UNITED STATES STEEL

Sikorsky

State Officials Convene

(*Continued from page 26*)

The conventional plane of the future must compete with roadable planes and direct control giros. In England, 35-ft. jump take-offs have been made in giros with ordinary engines. The practice of storing energy in the rotor for landing may be followed in the future.

Automobile engines for planes are still alive and kicking. The particular applications tried so far were slightly disappointing but a new Ford Model B engine, for which the parts cost $150, looks good.

No "Darius Green" underwriting

Insurance rates for fliers are not the result of a "Darius Green" method of underwriting, according to J. E. Hoskins, of the Travelers. No other occupation has a special committee of actuaries devoting itself solely to its statistics.

The fundamental principles of insurance require that each policyholder pay a rate of premium sufficient to pay his share of the claims among a group of similar policyholders.

It has been found, for example, that in airport and cross country taxi flying the consistent death rate is about eight pilots for every 100,000 hours flown. Pilots engaged in these classes of operation, averaging 300 hours per year, must contribute $24 a year for each $1,000 owned to pay for the death claims arising from air accidents.

There is a high spot in the mortality rate for transport and military pilots with 200-500 solo hours probably due to over-confidence.

The odds are 25,000-1 against a passenger's being killed on a scheduled transport trip. The death rate on the average air transport trip is about 1½ passengers per 100,000 passenger hours. In a group of policy holders who travel 100 hours each a year on the airlines, the death claim cost on account of air transport accidents to the insurance company averages $1.50 a year for each $1,000 of insurance. Since the average premium per $1,000 is about $30 and may go as low as $10 for short term insurance, some companies feel that the additional $1.50 should be added to the premium. This does not imply that the risk of air travel is great but that it is above the average.

World Aeronautics

Drawing a world picture of aeronautic progress and reporting on the work in airport and airplane development and traffic control of the Bureau of Air Commerce, Col. J. M. Johnson, Assistant Secretary of Commerce, addressed the delegates at the closing banquet. Col. Johnson concluded his remarks with a definition of the duties and responsibilities of State and Federal aviation officials. He told of the major program, now underway, to revise the regulations of the Air Commerce Bureau, to adapt them to the expansion of aeronautics expected in the next decade. The most important of the new regulations will be circulated among a select group of interested persons for inspection and comment.

New Volumes

New arrivals in the office library

AIRPLANE DESIGN-PERFORMANCE, *by Edward P. Warner; McGraw-Hill Publishing Company, New York and London; 1936; 653 pages, 430 illustrations; $5.*

MANY a man who stands high in the field of airplane design today cut his aeronautical wisdom teeth on Warner's Aerodynamics of Airplane Design (1927). Safe to say, also, that no airplane of the last six or seven years came into being without frequent thumbing through the pages of this classic work. But none better than the author realized that the period 1927-1935 had witnessed sweeping changes in many aeronautical concepts, and that the original volume had "fallen badly out of step with the art." Early in 1935, therefore, he embarked on the tremendous task of revision.

The job proved, however, to be much more than mere revision. Aerodynamic research had yielded so many new facts and modern operating technique had opened up so many new applications, that an entirely new plan of presentation had to be adopted, the text had to be almost completely rewritten, and practically all of the original charts (where they could be used at all) had to be redrawn. The common idea that an author of a text book can get up a new edition of a previous work "with the greatest of ease" simply did not apply to this case. It is substantially a new job from cover to cover.

And the result is well worth the effort. Not only is the subject matter beyond reproach in the usual Warnerian tradition for accuracy and completeness, but the readability has been tremendously improved. The earlier work carried with it the more or less formal atmosphere of the classroom and lecture hall. The style of the present volume, however, shows the influence of the author's later experience as an editor, and of his close contact in recent years with industry people. It is noticeably simpler, almost conversational in places,—all of which helps carry the reader over the tough spots.

Again, as in the first edition, the author's objective has been to confine the theoretical treatment to "very modest knowledge of mathematics of collegiate grade." Long demonstrations of mathematical theory have been sacrificed in favor of presenting final results in simplified form and in relating them to the practical experience of the reader.

Where it was possible to cover the entire field of aerodynamics in one volume in 1927, the great mass of data that has accumulated in the interim has made it necessary to divide the subject in 1936. The present volume, therefore, deals only with airplane performance and with the basic aerodynamic laws and phenomena that control it. A second volume on stability and control is promised for the near future.

•

AIRPLANE AND ENGINE MAINTENANCE FOR THE AIRPLANE MECHANIC, *by Daniel J. Brimm and H. Edward Boggess; Pitman Publishing Corporation, New York and London; 1936; 493 pages, board covers; $2.*

ONE of the most practical books we have seen for a long time. It was designed for a specific purpose, to give the student and the mechanic at work in the field practical information about his job in a clear and understandable manner. The authors are to be congratulated upon the degree to which they have stuck to their basic idea. Too often books of this sort lose effectiveness by wandering off into theoretical fields that confuse rather than clarify. Frequent illustrations (photographs and diagrams) help the student visualize what it is all about.

Four main subjects are treated: Aircraft wood work; Aircraft metal work; Aircraft fabrics and finishing; Rigging, handling and maintenance. The authors have drawn heavily on equipment manufacturers for details, but have supplemented and coordinated the material out of their wide experience in engineering, operating and in student construction.

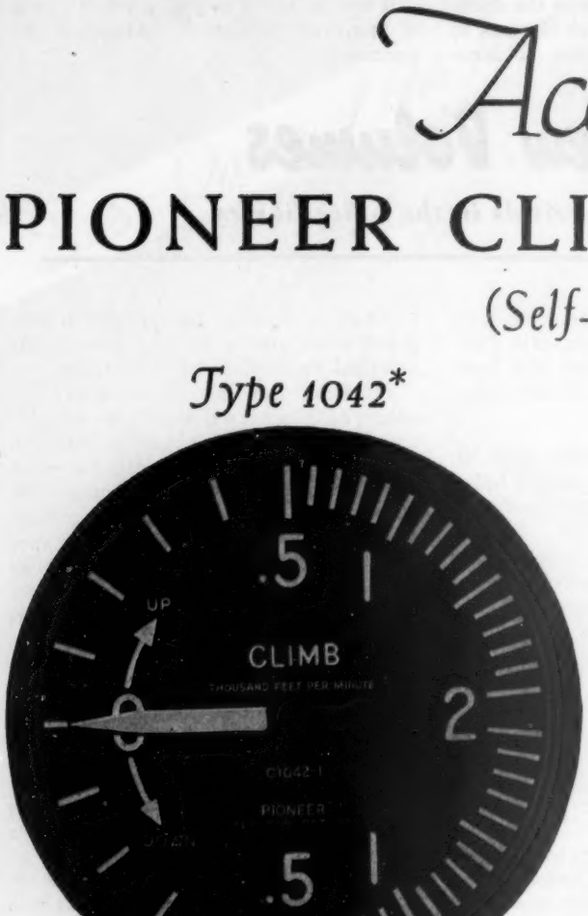
Mechanically the first edition may be subject to some criticism. A commendable effort has obviously been made to keep the price of the book down, but in view of the fact that it would be used to best advantage in the shop, we are afraid that the binding and the covers will not be able to take it. We hope that future printings will be a little more stoutly put together, even if the price must be advanced slightly. It would be worth it.

Accepted

PIONEER CLIMB INDICATOR

(Self-Contained)

*Type 1042**



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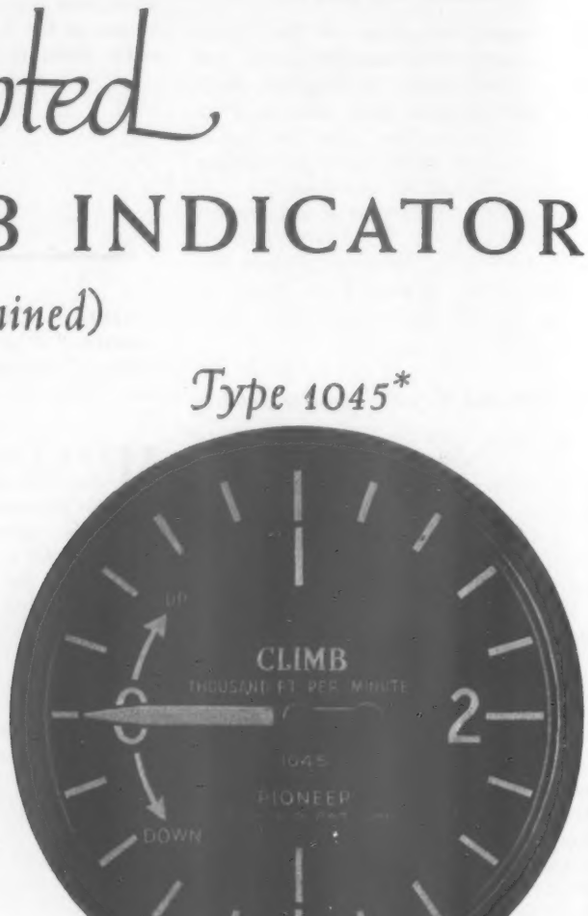

The latest design of the Climb Indicator (bottleless) is presented in two versions. The complete instrument, contained in a standard A. N. case, 3¾ inches deep, requires no external reservoir • Type 1042*, graduated in intervals of 100 feet per minute, makes possible extremely close reading in the lower half of the scale • Type 1045* has a standard scale with even graduations of 200 feet per minute for the range of 2000 feet • Both instruments are thoroughly compensated for temperature and altitude changes, and a unique device holds the humidity within the case constant. These combined features make for an extremely sensitive and accurate instrument that has won world-wide approval.

PIONEER INSTRUMENTS

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Deutschland uber dem Nord Atlantik

(*Continued from page* 17)

the cooling water are mounted high in the nacelles. When necessary they can be replenished from the water storage tank in the hull by means of a semi-rotary hand pump.

Tubular radiators for cooling the lubricating oil are hung in the air stream under the wing outboard from the turret. For summer operations in the tropics, additional radiation for the cooling water has been provided by means of flat-type radiators suspended below the wing surfaces outboard from the tubular oil radiators described above.

Of particular interest are the power plants themselves, the Jumo 5. Development of heavy oil engines of this type was begun by the Junkers Company as far back as 1924 when Professor Junkers built the first experimental aero diesel for test bench purposes only, but on the same principle as the present Jumo 5. After a long research the first aircraft diesel turned out was the Jumo 4 of 700 hp. which was fitted to several Junkers F-24 airplanes for experimental work. These engines proved so successful that Lufthansa installed them in the four-engine transports of their fleet, the Junkers G-38. A somewhat smaller engine which embodied all the experience gained with the Jumo 4 was built, the present Jumo 5.

These engines are of the compression ignition type, burning a special oil and developing 550 hp. each. The arrangement is six cylinders in line, but each cylinder is double-acting, containing two pistons each of which drives a separate crankshaft. The two crankshafts are geared to a common propeller shaft. These engines operate on the well known diesel principle in which air is compressed in the cylinders and fuel is injected into the heated air at the proper instant. There are, therefore, no ignition systems, no carburetors and no valves of the type used in other aircraft engines. The fuel consumption of these engines is extremely low. [Jane's "All the World's Aircraft-1935" gives a fuel consumption of .353 to .375 lb. per hp. at normal output; and .375 to .396 lb. per hp. at maximum output.—Ed.]

So much for the airplanes and their engines. Another interesting item of mechanical equipment in the Atlantic operation is the catapult as installed on the *Schwabenland*. It is essentially of the same type as originally mounted on the *Westphalen* but with improvements. Where the catapult equipment on the *Westphalen* was forward, however, on the *Schwabenland* it is aft. The flying boats are launched from the stern of the ship. During catapulting operations, enough sternway is kept on the steamer to maintain the heading into the wind at all times. As can be seen in some of the accompanying photographs, the catapult is mounted on the port side of the ship with the crane and the track for handling a spare airplane to starboard. The reel and arrangement for handling the sea apron is located at the stern below the catapult.

The catapult proper consists of two long steel rails (about 100 ft. in the clear) on which is mounted a car, or rather a sledge. The latter is not mounted on wheels but slides directly on the top of the rails.

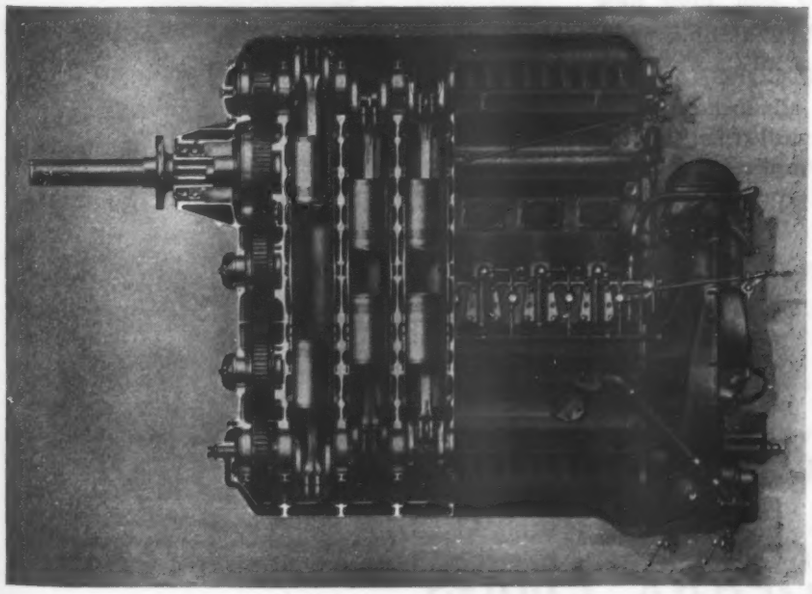
The carriage is pulled along the catapult by two flexible steel cables each of which is about 2 in. in diameter. They are kept well lubricated, both for protection against corrosion and for flexibility. The cables pass over a large pulley near the discharge end of the catapult and from thence under the structure to the operating cylinders located about the center of the framework. Here the cables pass back and forth over a system of sheaves arranged very much like the ordinary block and tackle. One set of sheaves is stationary and the other is mounted on a slide which in turn is connected to the piston of a large air cylinder. By forcing the two sets of sheaves apart by the action of the air cylinder the relative motion of the piston is compounded so that for every foot of travel of the piston, 6 ft. of travel on the catapult carriage is obtained.

Compressed air for operating the launching cylinder is stored in large tanks immediately below the cylinder. Pressures between 1,200 and 1,400 lb. per sq.in. are employed. Take-off speed is varied according to the speed of surface winds by varying the pressure of the compressed air.

With the plane on the carriage in the take-off position the two engines are warmed up and are finally run up to full throttle. After the crew have gotten themselves properly braced in their places, the pilot pushes a small button under his right thumb on the steering wheel which flashes a red light at the firing station. The catapult engineer then throws a lever opening the valve connecting the compressed air container and the cylinder, the piston forces the two sets of sheaves apart, and the carriage is accelerated along the catapult. In one and one-half seconds the boat is accelerated from a standstill to about 80 m.p.h. Since this is above the minimum flying speed for the boat, it is able to climb directly after having left the catapult. There is no loss of altitude.

Actually the boat leaves the carriage somewhat before the end of the catapult is reached. Then the problem is to stop the carriage. This requires considerable braking. The structural steel cradle must be decelerated from 80 m.p.h. to a standstill in about 15 ft. Two sets of brakes act. The first consists of a knife-like vertical plate mounted on the under-part of the carriage which slides between pairs of stationary steel shoes under the end of the track. The shoe plates are pressed together horizontally by air cylinders. The pressure in the brake cylinders is the same as that used for the firing cylinder. The other braking action comes from the launching cables. Since the pulley at the discharge end of the catapult is not at the extreme end, the carriage over-runs it and the cable then acts in a reverse direction tending to stop it. During this part of the cycle the compressed air cylinder acts as a sort of dashpot to retard the carriage with minimum shock.

Although the accelerations acting during catapulting may run as high as 2 to 2½ g., there are no noticeable ill effects on the crew in as many as five or six launchings a day.



Junkers Jumo Model 205 engine.

At Last!

A NOCORONA* SPARK PLUG

•

CHAMPION NOCORONA* AIRCRAFT SPARK PLUGS FIRST TO ACHIEVE LONG SOUGHT RESULT

It was only recently determined that corona occurring within mica spark plugs was one of the causes of missing, hard starting and rough engine performance in aviation motors. Likewise, it was established that corona was present in practically all mica aircraft spark plugs of conventional design.

Champion has just had the great satisfaction of developing a coronaless and at the same time an absolutely gas-tight or compression-proof mica aircraft spark plug, in both the shielded and unshielded types. These two long sought advantages are available only in Champion NOCORONA Spark Plugs and definitely bring new standards of engine performance and dependability to all aircraft engines.

The aircraft industry only recently realized the importance of coronaless spark plugs in aircraft engines. Champion is proud to announce that their new NOCORONA Spark Plugs meet this rigid requirement.

Tests substantiate that Champion NOCORONA Spark Plugs do smooth out performance, eliminate missing and make starting much easier. Install a set in your ship and see for yourself what Champions will do for your engine. Available in the latest radio shielded or unshielded type.

Contractor to U. S. Army Air Corps.

*Corona is electrical current leakage within the mica insulation and paralleling the center electrode of the spark plug. It is visible through the translucent mica core and obviously impairs the spark at the gap.

CHAMPION NOCORONA MICA AIRCRAFT SPARK PLUGS

The Maintenance Notebook

Short Cuts from the Overhaul Shops

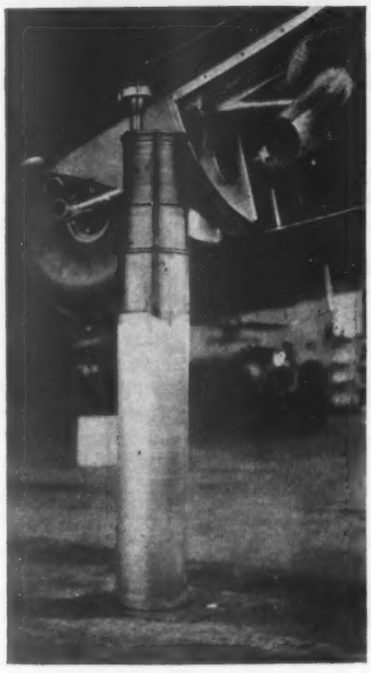
Hangar Jack

Hydraulic equipment aids the servicing of Chicago and Southern planes

HYDRAULIC hoists or lifts of the type commonly found in automobile servicing stations should find a number of applications around airports and in airline maintenance shops. The simple type of hydraulic elevator might be installed on loading aprons to facilitate hoisting of mail and cargo into airplanes to replace the slow and awkward stepladder method now in general use. One manufacturer, the Curtiss Pneumatic Machinery Company has furnished plunger type elevators for leveling up airplanes for checking compasses and other instruments.

The hoist heads are removable when not in use so that the floor can be kept absolutely clear of obstructions.

The ship can be lowered so that mechanics can work on the nacelles and engines without step-ladders.



Closeup of Chicago and Southern hydraulic hoist showing the ship in the up position with wheel retracted.

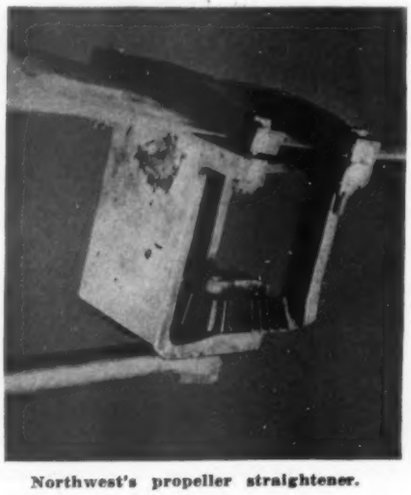
Bruce Brown, operations manager for Chicago and Southern Air Lines, reports that they have installed hydraulic hoist equipment in their overhaul shops on the Lambert-St. Louis Municipal Airport. A pair of hydraulic hoists was installed in the hangar floor on centerline distances equal to the center-to-center distance between jack pads on the Lockheed Electra now in use. The airplane is run into position over the jacks and raised clear of the floor so that the undercarriage may be retracted and extended for service check and overhaul. With the undercarriage retracted, it is also possible to lower the whole airplane down close to floor level so that it is possible to do all work around the engines and nacelles without the use of stepladders.

The hoist used is of the regular automobile type operated by compressed air. It is a length of stroke of 54 in. and operates on between 70 and 80 lb. of air. The tops of the jacks were made removable so that the floor would be entirely clear when the jacks are not in use. Note also that a special fitting has been made on the top of each jack to take care of minor differences in dimensions of the hoisting points and also so that the ship would not have to be too accurately placed in order to use the jacks. The rotatable motion on the top of the jacks also allows for fore and aft movement of the ship when raising and lowering it.

Propeller Straightener

Device developed for straightening and tracking bent blades

IT IS no easy thing to straighten bent aluminum propeller blades by the means ordinarily at the disposal of the small repair shop. To provide something for the small shop owner, Northwest Air Service, Inc. (Seattle, Washington) has developed a tool that will turn out a very satisfactory job. It will not only straighten damaged blades, but may be used for repitching Curtiss-Reed or other similar propellers As shown in the photograph, it consists of two large clamps which may be rotated, one with respect to the other, by means of a lever and a gear and pinion. One of the clamps carries a heavy frame in which the pinion is mounted, the other carries the gear sector. The tooth ratio is six to one, and with the leverage furnished by the long handle, one man can apply sufficient pressure to straighten any standard aluminum alloy blade. Straightening operations are begun at the point nearest the hub and proceed outward progressively toward the tips. The "bite" of the clamps is 6 in. so that the work is done at 6 in. stations along the blade. The straightener is designed to be used with the propeller mounted on the pitch stand. Northwest Air Service, Inc., is putting a number of these tools into production and they are now commercially available.



Northwest's propeller straightener.

News of the Month

Highlighting recent events in the aviation world.

★ ***World Transport*** **. . . Passenger service in Pacific.**

★ ***Domestic Transport*** **. . . 95 per cent passenger increase for Chicago & Southern . . . Electras for Boston-Maine . . . Eastern turns to men stewards . . . Braniff will fly to Mexico City . . . More DC-3s for American . . . Drastic fare reductions on TWA.**

★ ***Research*** **. . . High altitude studies forecast new ships, new methods for TWA.**

★ ***Navy, Coast Guard*** **. . . Bids for Navy patrols, scouting bombers, opened . . . Order for Coast Guard flying boats to Hall Aluminum Aircraft.**

★ ***Bureau*** **. . . Reports on Chicago & Southern crack-up.**

★ ***Races & Shows*** **. . . One entrant finishes 6,150 mile England-South Africa race . . . 40 reservations reported for New York show.**

★ ***Industrial*** **. . . Arrow incorporation . . . Year's exports at $14,000,000 . . . DC-3s to K.L.M. . . . Fairchild splits up . . . Order for Stearmans . . . Grummans for export to be made by Canadian Car & Foundry.**

World Transport

Two oceans and three continents are drawn closer together by airplane and airship

MAN'S DREAM of flying around the world on scheduled lines moved steadily toward realization on four important fronts last month: start of passenger service across the Pacific by Pan American, further experimental flights in the North Atlantic by Germany's Lufthansa, the end of a successful season of transocean flying for lighter-than-air, and official American rumblings of support for a resuscitation of our own dormant lighter-than-air activities.

Pan American announced Sept. 21 that passenger service on its Alameda-Manila route—the Pacific Division—would start Oct. 21, after Bureau of Air Commerce inspectors had made a final check-up on operations. Fifteen first-flight passengers were chosen from the more than 1,100 who had filed applications.

But first passenger honors actually went to gentlemen of the press, for on Oct. 7 five newspaper men climbed aboard the China Clipper at Alameda for a 16,400 mile "preview" flight. It was the fifty-second scheduled crossing to Manila since Captain Edwin C. Musick, PAA's senior pilot, took off from San Francisco Bay last November and, added to the earlier survey flights of the Sikorsky Pan American Clipper, marked up a record of 518,000 ocean-miles.

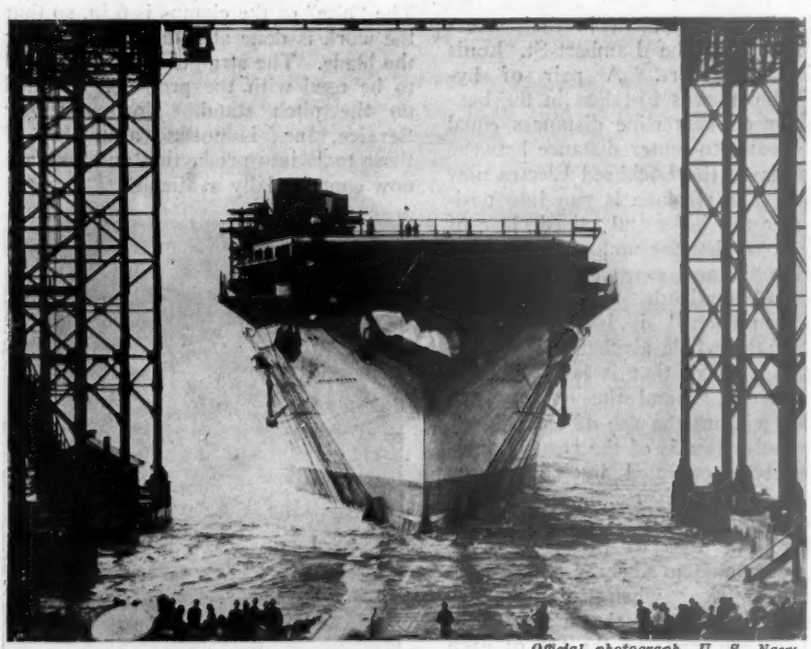
For the most part the trip was uneventful, the Clipper hopping from Alameda to Honolulu to Midway to Wake on schedule. At Wake, take-off was delayed two days, because typhoons in the vicinity of Guam held up the Hawaii Clipper, eastbound from Manila. It was thought inadvisable to trust both ships at the same time to the ground crew at Guam, where the water was very rough.

After finally getting off on Oct. 15, Capt. Dahlstrom turned back in the face of a headwind that slowed the ship down to 356 miles in three hours fifteen minutes of flying. The Hawaii Clipper, eastbound, had arrived in Guam the night before, and took off after the China Clipper, bearing André Priester, PAA's chief engineer, and Charles Monteith, chief engineer for the Boeing Airplane Co.

A second preview flight, carrying a number of newspaper publishers and Pan American president Juan Terry Trippe, left Alameda Oct. 14 in the Philippine Clipper.

New transoceanic flying equipment for the line will come from the Boeing shops at Seattle, where orders have been placed for initial engineering and construction work on six 82,000 lb. flying boats. They will have a 152 ft. spread, and will carry 60 passengers, with sleeping accommodations for 40. First one will be ready late next fall.

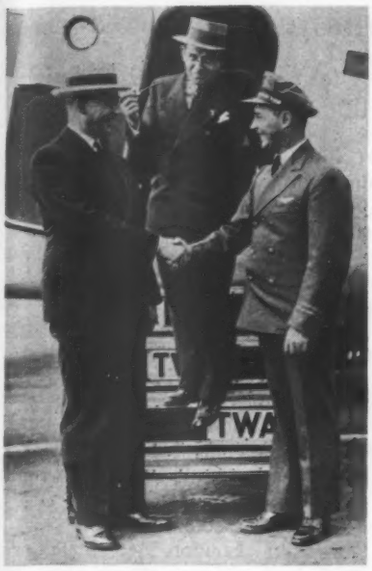
The North Atlantic field of interest was divided between Lufthansa's experimental Dornier flying boats, Zephir and Aeolus, and the Deutsche Zeppelin Reederei's dirigible Hindenburg. Following the flying boats' arrival at Port Washington, N. Y., from the Azores and Bermuda (AVIATION, October, 1936), the mothership Schwabenland steamed to Long Island Sound, made two demonstration launchings, then



Official photograph, U. S. Navy

ENTERPRISE

newest of the Navy's floating airports, slides down the ways at Newport News, Va., after its champagne bath at the hands of Mrs. Claude A. Swanson.



RUDOLPH JAHN
(left) Lufthansa's American representative, sees technical director Baron Karl von Gablenz (center) off on a TWA flight to Chicago.

catapulted the Aeolus off for a seventeen hour 47 minute return flight to the Azores. The Zephir took off under her own power and flew to Bermuda, where she was again hauled aboard the Schwabenland and sent on her way to Horta.

Oct. 6 and 7 the two boats returned to Port Washington, and were scheduled to go from there to Nova Scotia to be catapulted again from the deck of the much-travelled Schwabenland on a flight to Ireland. This is the second of two trans-Atlantic routes being considered (see page 15).

Then a diplomatic monkey wrench was dropped into the machinery when the Irish Free State Government refused the Germans permission to land. Grounds were that the Free State was bound by the Ottawa North Atlantic Air Agreement, drawn up in the Ontario capital a year ago at a conference among Great Britain, Canada, Newfoundland and the Free State. This agreement requires consultation with the other powers before the granting of landing privileges to a power not signatory.

Farewells to the Hindenburg until next March were said Oct. 9, when the 811 ft. dirigible lifted gently from her mooring at the Naval Air Station, Lakehurst, N. J., and faded quickly from view in the dense fog of a rainy night. She bore 55 passengers, bringing the total passenger list for the Summer's ten round trips to well over a thousand. She nosed over the cold Atlantic on that twentieth crossing leaving a profound impression of fast, efficient, and comfortable service in American minds. For ten hours that day she had carried 84 passengers—the top rank of American business and finance—on a 700-mile tour of northeastern States. Overwhelming enthusiasm for lighter-than-air travel was the result.

That enthusiasm aparently started the wheels turning, for a few days later Col. J. Monroe Johnson, Assistant Secretary of Commerce, announced plans for submission to next winter's Congress of an amendment to the Maritime Act of 1936 allowing lighter-than-air the same government privileges granted the merchant marine. Widely rumored are plans of Paul W. Litchfield, president of Goodyear-Zeppelin, to construct another dirigible.

Some lighter-than-air experts feel that America's most sensible next move is to charter or buy from Germany the Hindenburg's sister ship, now building at Friedrichshafen. It is scheduled to be ready for service next July or August.

A lighter, but nonetheless significant, event in last month's world transport news was the simultaneous air journey around the world by three New York reporters. Intended to demonstrate the feasibility of a twenty-one-day circumnavigation using scheduled services only, it soon developed into a race, with H. R. Ekins, of the New York *World Telegram* finally chartering a plane in India. This enabled him to catch the Hawaii Clipper of Pan American Airways at Manila. He was listed as a member of the crew. The other two, Leo Kiernan of The New York *Times*, and Dorothy Kilgallen of The New York *Journal*, had to wait for the China Clipper.

High Altitude Research

Tomlinson to fly TWA's "over weather laboratory." Briton sets new World mark as part of R. A. F. experiments.

A PROGRAM of high altitude flight research and announcement that "within two years" planes with 50-passenger capacity and 150 ft. spans will be in service on the transcontinental route has revealed a significant new equipment program for Transcontinental & Western Air.

It is proposed in the future to make all long-distance flights "overweather"—a term copyrighted by TWA, meaning flight at those altitudes, say 30,000 ft., which are generally above the reach of storms and where turbulence is seldom encountered. This, in TWA's opinion, will require supercharged cabins.

The line is already party to a development project calling for a "standard" plane for use on five lines (including American, Eastern, United and Pan American). That ship, being engineered in the Douglas shops at Santa Monica, calls tentatively for a 140 ft. span and 40-passenger accommodation. But the only provision for high altitude work so far reported is an arrangement to bleed oxygen into the ventilating system. This is not considered sufficient for sustained operation at 30,000 ft. or better.

In view of TWA's natural proclivity for blazing its own trail, few observers are surprised that the company is turning to some other manufacturer for future new equipment. It does not necessarily mean desertion of the joint development project, for normal altitude equipment will be needed for local runs.

For the research work, a Northrop Gamma, once used by President Jack Frye for his personal transportation, has been fitted out for use as an "overweather laboratory." Flights to 35,000 ft. have already been made. The pilot is D. W. Tomlinson, assistant to Paul E. Richter, TWA vice-president in charge of operations. It was Tomlinson who piloted the famous DC-1 to a long string of national and international records in the speed-weight-distance category.

ALTITUDE RESEARCH
(top) Tommy Tomlinson, with his special microphone frame, ready for 30,000 ft.; (bottom) Observer James Heistand surveys the array of engine instruments in the TWA overweather laboratory.

In the observer's compartment is James Heistand, TWA's development engineer. Before him will be an array of 36 instruments to tell an accurate story of the functioning of the engine. Engine performance—operation of supercharging equipment, fuel consumption, speed differentials, temperatures—will be the primary concern of the experiments.

To help accurate recording, a camera is suspended in the rear of the observer's compartment. With every 1,000 ft. gain in altitude, two lights will be turned on the instrument panel, and a picture of the instrument group taken.

Pilot and observer will be enabled to withstand the rigors of cold and low pressure by the use of heaters and breathing tubes for oxygen supply. No special clothing will be worn. Tomlinson's cockpit is provided with a special microphone frame which also holds his oxygen tube, allowing him to keep in communication with the ground by radio and take necessary oxygen at the same time, leaving his hands free for flying.

Also engaged in a high altitude research program is Britain's Royal Air Force, through the Royal Aircraft Establishment at Farnborough. On Sept. 29, in the first phase of the program, Squadron Leader F. R. D. Swain captured the world airplane altitude record from the Frenchman Georges Detré, who himself had broken it little more than a month earlier. Swain's height, yet to be homologated by the F.A.I., was 49,967 ft.

The ship he flew, known as Bristol 138, was ordered from the Bristol Aeroplane Co. in November 1934, and was the result of studied specifications on the part of the Air Ministry and skillful execution by Bristol engineers. It is a low-wing, unbraced, monoplane, constructed, for lightness, entirely of wood. Span is 66 ft., length, 44 ft. Wing loading is very light (8.53 lb./sq.ft.). Total empty weight is 4,391 lb.

The Bristol Pegasus engine, P.E. VI S, is fitted with a two-stage supercharger, and swings a four-bladed wooden propeller 12 ft. 9 in. in diameter. The engine was designed to deliver 335 hp. at 10,000 ft., and 457 hp. at 40,000 ft.

The pilot's special equipment consisted of a rubberized-fabric pressure suit, made in two sections and fitted with a helmet of the same material, with a large curved double window. Oxygen supply is through a closed circuit, with carbon dioxide and moisture content removed from the used breath before it is returned to circulation.

A second high-altitude plane, similar to the Bristol 138, has been constructed, but it will be powered with a water-cooled Rolls-Royce Kestrel. The Pegasus is an air-cooled radial. Further flights will be made "in due course."

Flight photos

BRITAIN'S PROGRAM

(Top) F.R.D. Swain climbs (bottom) the Bristol 138.

New York Show

Three months before opening, 40 space applications reported

ALTHOUGH it will be three months before the National Aviation Show (Jan. 28–Feb. 6) will open its doors to the public in Grand Central Palace, New York, managing director Gustave A. Parsons has reported that more than 40 prospective exhibitors have reserved space. It will be the first aircraft show to be held in New York since 1930—seven years.

Parsons has estimated that of the 250,000 expected to attend, "at least 10,000 are potential new cash customers for air travel, for instruction, for planes and accessories."

Johannesburg Race

Only one entry in nine finishes 6,150-mile grind

LAST May I. W. Schlesinger, wealthy South African sportsman, offered $50,000 for an all-British air race between England and South Africa. The race was to be divided into speed and handicap contests. First prize in the speed event: $20,000. Handicap prizes ranged from a first of $15,000 to a fourth of $2,500.

The course was laid out from Portsmouth, England, to Johannesburg, with a turning point at Belgrade, Yugoslavia, and a landing control at Cairo.

Nine planes took off from Portsmouth in the dawn of Sept. 29. On Oct. 1 Charles W. A. Scott—co-winner of the McRobertson London-Melbourne race in 1934—and Giles Guthrie tore into Germiston Airport, Johannesburg. They had driven their Gypsy-powered Percival Vega Gull over the 6,150-mile course in 52 hours 56 minutes, and were the only entrants to finish at all. The other eight ships were scattered from Regensburg, Germany, to Gwelo, Southern Rhodesia, either downed by mechanical failure or crashed. Two contestants—Capt. Max Findlay and A. H. Morgan, flying an Airspeed Envoy with Kenneth Waller and C. D. Peachey—were killed in a take-off crash at Abercorn, on Lake Tanganyika.

Industry Expands

K. L. M. Douglases; Lockheed backlog; Fairchild reorganizes

ARROW AIRCRAFT CORPORATION has been incorporated at Lincoln, Neb., with an authorized capital of 300,000 shares of $1 par value common stock. The company has purchased domestic manufacturing and sales rights for the Arrow Sport V-8, along with machinery for manufacturing, and has leased space in the Arrow Aircraft & Motors Corporation's $500,000 plant at Lincoln.

Oct. 14 Robert & Company of New York, N. Y., offered 200,000 shares of the stock at $1 per share. Arrow expects to inaugurate a production schedule of four planes a day. Officers of the company are Mark W. Woods, president; George Woods, vice-president; F. Pace Woods, executive vice-president, and John G. Aldrich, secretary-treasurer. Consulting engineer is D. E. Anderson, chief engineer of the Bohn Aluminum & Brass Company, of Detroit.

The Beech Aircraft Corporation is planning a stock issue to net approximately $400,000. Walter H. Beech, the company's president, said that part of the proceeds will be used to purchase from the Curtiss-Wright Airplane Com-

From faltering flight

TO RIGID AIR LINE SCHEDULE

Roebling has pioneered in the development of Wire Aircraft Products

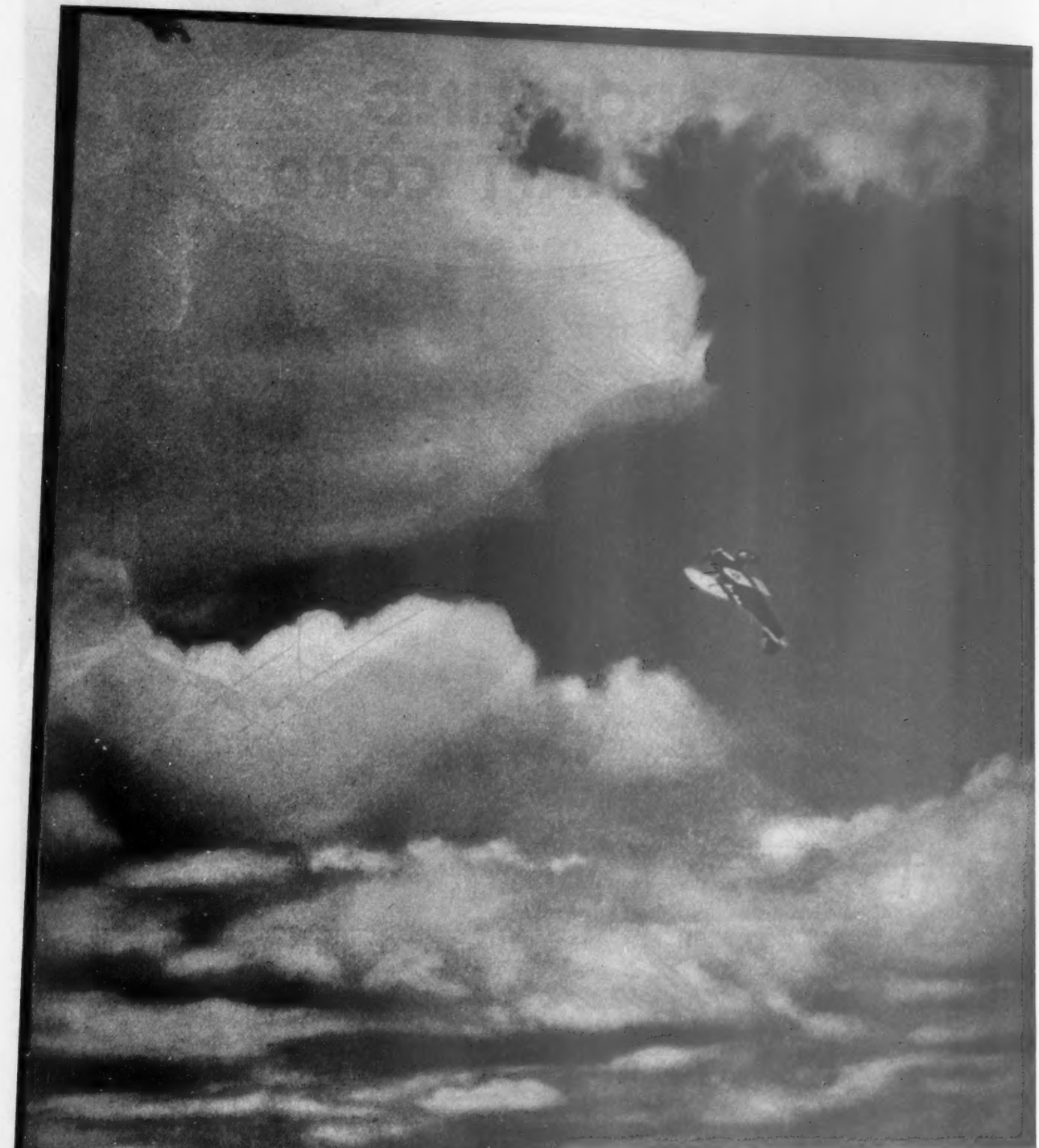
TODAY and since the inception of the aviation industry, Roebling keeps step with an industry whose constant watchword has been Progress. Most principal plane builders now turn to Roebling for the solution of their wire and cable problems. And in the years to come Roebling will continue to pioneer in the improvement of wire aircraft products.

Roebling Wire Aircraft Products include:— *Tinned Aircraft Wire; 19-wire Aircraft Strand, Tinned or Galvanized; Aircraft Cord {6 x 7, 7 x 7, 7 x 19}, Tinned and Galvanized; Ferrules and Thimbles; Serving and Locking Wires; Control Strand and Casing; Electrical Power and Lighting Cables; Gas and Electric Welding Wire.*

John A. Roebling's Sons Co., Trenton, N. J.

ONLY A FINE PRODUCT MAY JAR **BEAR THE NAME ROEBLING**

SPIRIT!



● Up in Canada the flyers sometimes call gasolines "*spirits.*" This makes us feel good. Phrases run through our head like—the spirit of aviation . . . the spirit of a motor . . . the spirit of power . . . To us, on the south side of the border, it may seem odd to endow any ordinary gasoline with the fighting qualities of a word such as *Spirit!* But for Ethyl it's just right! Ethyl Gasoline Corporation, Chrysler Building, New York City.

pany the manufacturing plant at Wichita, Kan., which it now leases.

K.L.M. (Royal Dutch Airlines) has purchased eight Douglas DC-3s from the Douglas Aircraft Co., Santa Monica, Cal. The first of the order left Santa Monica Sept. 21 for New York. The other seven will be delivered next spring.

Ex-Cell-O Aircraft & Tool Corporation, Detroit, has announced the appointment of the Herberts Machinery Co., Ltd., Los Angeles, as exclusive sales representative in southern California.

Fairchild Aviation Corporation stockholders were scheduled to vote Nov. 2 on a proposed split-up of Fairchild subsidiaries. Under the segregation plan, Fairchild Aviation would retain full ownership of the Fairchild Aerial Camera Corporation, which manufactures aerial cameras and other precision aircraft instruments at Woodside, Long Island, and its interest in Fairchild Aerial Surveys, Inc. The airplane and engine manufacturing subsidiaries, Fairchild Aircraft Corp., of Hagerstown, Md., and the Ranger Engineering Corp., located at Farmingdale, Long Island, along with the corporation's interest in Fairchild Aircraft, Ltd., of Canada, would be transferred to a new company, Fairchild Engine and Airplane Corporation.

The plan calls for the distribution to present stockholders of shares of the new concern on a share-for-share basis. One feature of the plan calls for cancellation of $820,000 of 6 per cent Fairchild Aviation Corp. notes, for $445,060 of which holders will accept 52,360 shares in the present corporation. For the balance, holders will accept 3,794.4 shares of $100 par, five per cent convertible preferred stock in the new Fairchild Engine & Airplane Corp. Dividends on this stock will not be payable or commence to accrue until January, 1938. Sherman M. Fairchild will continue as president and chairman of the board of Fairchild Aviation, and will occupy the same positions in the new company.

Robert E. Gross, president of Lockheed Aircraft, has announced that the September order backlog—$1,250,000—was the largest in the company's history. A new transport, similar in design to the Electra, is on the drawing boards of Lockheed engineers at Burbank. It is known as the "Super-Electra," and is designed for fourteen passengers. Already orders are reported "from a large airline."

Capital stock of the Glenn L. Martin Co. has been increased from $1,000,000 to $1,500,000, consisting of 1,500,000 shares of common stock with a par value of $1.

Menasco Manufacturing Co. has reported a $100,000 engine order backlog, with recent orders from Germany and Japan. A registration statement has been filed covering issuance of 70,000 shares of stock with a $1 par value. They will be offered at $3.75 a share, the proceeds to be used for machinery purchase and equipment.

Sept. 30, Seversky delivered the last 35 basic trainers under its first Army Air Corps contract, and will concentrate on its contract for 85 pursuits.

With plans for a production schedule of one ship a month, Spartan Aircraft Co., through vice-president and general manager Edward W. Hudlow, has issued a call for 50 additional men.

The Philippine Constabulary Air Force has placed an order for six training planes manufactured by the Stearman Aircraft Company, Wichita, Kan. Three will be Model 73-L3 primary trainers, powered with Lycoming R-680-C1 engines of 225 hp. They are similar to the three delivered to the Philippines last spring. The other three, Model 76-D1, are equipped as advanced training and expeditionary types. They will be powered with 320 hp. Pratt & Whitney Wasp Juniors, Series T1B.

Tailorcraft Aviation Corp. has been incorporated at Alliance, O., for the production of C. G. Taylor's new light plane. Incorporation is for $54,000 (900 shares of $50 preferred stock and 1,800 shares of no-par common with a declared value of $5). President will be C. G. Taylor; vice-president, Alex Robertson; secretary, S. L. Geiger, and treasurer, George O'Brien. Five ships are under construction.

The Welch Aircraft Company, which recently moved to the Bendix Municipal Airport, South Bend, Ind., has sold two planes, one to Leroy Mabbitt, of Anderson, and the other to G. F. Koeller, Jr., of Mokena, Ill. Before winter the plant will be moved to the old South Bend Watch Co. plant, where work will start on an order for 50 planes for F. W. Bower, of Fowler, Ind.

Engineers and production men met in Los Angeles Oct. 15, 16, and 17 for the first Aircraft Production Meeting sponsored by the Society of Automotive Engineers. Men prominent in the industry discussed, in fourteen papers, problems accompanying the industry's rapid growth. Further details of the sessions will appear in AVIATION's December issue.

Calendar

Nov. 13–19—Fifteenth International Aero Exhibition, Paris, France.

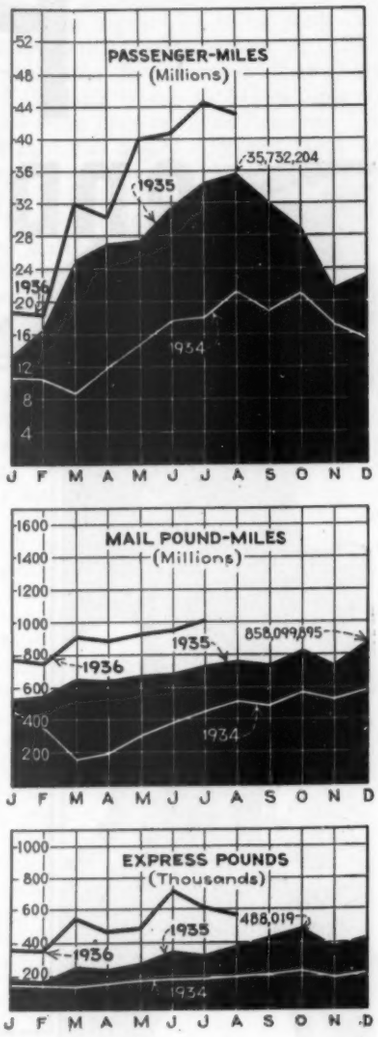
Dec. 10–11–12—Ninth Annual All American Maneuvers, Municipal Airport, Miami, Fla.

Jan. 28–Feb. 6, 1937—Aircraft Show, New York.

March 13–21—Second Annual Pacific Aircraft Show, Pan-Pacific Auditorium, Los Angeles, Cal.

Traffic

Latest available statistics from the Bureau of Air Commerce and the Post Office Department—Domestic airlines only



Taylor "Cubs" have been approved by the Bureau of Air Commerce with a 40 hp. engine installation, instead of the 37 hp. used heretofore. New engines will be the Continental A 40-4.

The Department of Commerce announced Oct. 1 that aeronautical exports for the first eight months of this year were valued at about $14,000,000. This was equal to the total value of exports for all of 1935, and an increase of 55 per cent over last year's first eight months. Observers feel that the end of the year may see a record total of $20,000,000 of aeronautical exports. The previous high was in 1934, when foreign purchasers bought $17,611,638 worth of American aircraft, engines and accessories.

FORMICA

PULLEYS

AND FAIRLEAD BUSHINGS FOR AIRPLANES

A VERY large percentage of the aeroplanes, both government and commercial, turned out by American manufacturers this year are equipped with Formica control pulleys and fairlead bushings.

The weight of Formica pulleys is approximately half that of the lightest metal pulleys for the same purposes. They are being constantly tested under the Army and Navy specification for inspection of pulleys, covering run-out tolerances, static load, bonding, flange shear and resistance to fatigue.

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THE FORMICA INSULATION CO.
4618 Spring Grove Ave., Cincinnati, Ohio

Routes, Equipment, Rates

Electras for Boston-Maine; United issues stock; Mexican service on Braniff; American orders DC-3s; air freight service by TWA.

IN THE upward trend of airline business, Chicago & Southern Air Lines contributes its full share. The first nine months of this year saw an increase of 95 per cent in the number of passengers carried over the same period in 1935, with 6,510 passengers from January to October. In the same period, air mail poundage increased 33 per cent, express poundage 50 per cent.

Bimotored Lockheed Electras were scheduled to go into service on Boston-Maine–Central Vermont Airways about Oct. 15. The Boston to Burlington, Vt., schedule will be cut from two hours and fifteen minutes to one hour and 31 minutes; from Boston to Bangor, Me., from two hours and twenty minutes to one hour and thirty-five minutes. Actual flying time will be even less, because those times include five minute stops at ports of call.

Pennsylvania Airlines, operating between Washington and Milwaukee, showed gains in passenger, mail, and express traffic ranging from 24 to 208 per cent for the first eight months of this year. Air express was first, with 208 per cent, while air mail (carried only on the Detroit-Milwaukee portion of the system) climbed 136 per cent. The line carried 37,089 passengers for the first eight months—24 per cent more than the same period last year.

September 23 stockholders of United Air Lines authorized increase in the number of shares from 1,200,000, with a $5 par value, to 2,000,000, with the same par value. They will be offered to stockholders at $11 a share, on the basis of one new share for each three now held.

The offering will net the company about $3,800,000, which will be used to pay for the twenty Douglas DC-3s now on order, and to improve ground facilities for the new ships' use.

For a third crew member, Eastern Air Lines has turned to men. On Dec. 1, according to E. V. Rickenbacker, general manager, "flight-stewards" will be placed aboard every plane. Their duties will be similar to those of the hostesses used on some other lines. According to the announcement it will be their policy to be "courteously attentive when needed, almost invisible at other times." Qualifications will include height of 5 ft. 4 in. to 5 ft. 8 in., weight of 125 lb. to 150 ib., and age ranging from 25 to 35. Positions are open to 40 men.

On Oct. 1 Douglas DC-2s replaced the 10-passenger Lockheed Electras on Eastern's 9½ hr. Chicago-Miami run. The change is attributed to increase in demands for space in the Chicago area.

A 750-mile foreign extension is under construction by Braniff Airways, to run from Brownsville, Tex., by way of Monterrey to Mexico City. This will provide direct connections from Chicago to the Mexican capital. The present connection at Brownsville with Pan American, serving Mexico City and Central America by way of Tampico, will be continued. Braniff's schedules will be arranged for a different time of day.

The work of mapping and laying out the new airway is under the direction of Don C. Walbridge, Braniff Operations Manager, who left Dallas Oct. 3 in a specially equipped car to survey the territory. The job entails construction of an airport at Monterrey and other intermediate landing fields, setting up a field transportation system, a complete radio system, and weather service. 14-passenger planes (presumably DC-2s, or the new Super-Electras) will be used.

Another order for Douglas DC-3 Flagships has been announced by C. R. Smith, president of American Airlines. Price is $105,000 each. This latest order calls for five, bringing America's complement up to 25. Thirteen have been delivered, of which eight are DSTs (sleepers). All others will be 21-passenger day planes.

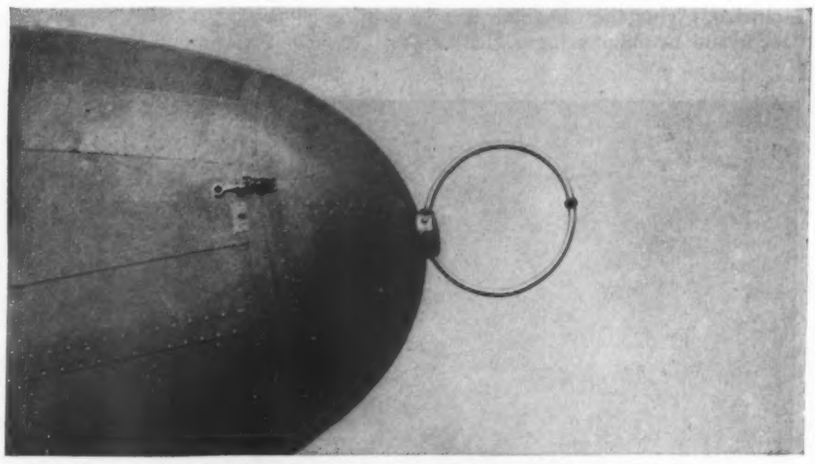
The ICC has postponed from Sept. 15 to Oct. 27 the hearing on Eastern's complaint that American was violating the air mail act by maintaining passenger service between Newark and Washington.

Sweeping reductions in passenger fares were announced late in September by Transcontinental & Western Air. They will go into effect Nov. 1 as special winter rates. By using scrip (air transportation purchasable in $500 blocks), the fare between New York and Chicago is cut to $33.96, only 71 cents more than rail plus Pullman. The old fare was $47.95. Winter fares for the transcontinental run are reduced from $160 to $118.96.

TWA's long-pending application before the ICC for off-line service between Albuquerque and San Francisco has been reported by ICC examiners George A. Keyser and Lucian Jordan. They held that the service was required by public convenience and necessity; that it would not tend to increase the cost of carrying mail, but recommended that the Commission deny the application because service would, under the air mail law of 1934, be illegal in that it "would be competitive in some way with the services upon the route of another air mail contractor."

Express-only service was instituted between New York and Chicago by TWA Oct. 19. Schedules called for midnight-to-dawn service in each direction, using Ford tri-motors with 3,500 lb. payload capacity. Rates are reduced from regular express charges as much as 57 per cent ($12 per 100 lb. New York-Chicago as against $28 per 100 lb. regular air express).

The Bureau of Air Commerce has announced the perfection of a radio typewriter service, which has been in operation between Washington, D. C., and Baltimore, Md., for a year and a half. It offers a means of transmitting



TO ELIMINATE STATIC
from rain or snow, United Air Lines has perfected this shielded loop antenna for reception of directive radio beams. It is installed in the nose of the ship.

and receiving typewritten messages without the use of land wires, and may be used with any number of receiving machines simultaneously.

It is proposed to install the service on the new airway which has been under construction for the past year between Washington and Nashville, Tenn. Cost is estimated at about $200,000, and the Bureau expects to save that amount in reduced transmission costs in a little more than three years. The typewriter developed for use aboard planes weighs only eight pounds.

Accident Report

Bureau unable to explain Chicago & Southern crash

A BUREAU OF AIR COMMERCE report on the crash of the Chicago & Southern Air Line Electra at St. Louis last Aug. 5 found no more informative cause than that the pilot "was making a turn at an extremely low altitude, for reasons unknown, in which the wing of the airplane unintentionally contacted the ground."

The pilot had turned back toward the field after "not more than two minutes" in the air, though why he had done so was characterized in the Bureau report as an "undeterminable factor" in the accident. Engines were apparently functioning normally, and at cruising speed or above. The Bureau holds that there is "insufficient evidence to substantiate any" of "several theories" as to the accident's cause that had been suggested.

Export Grummans

Manufacturing rights sold to Canadian Car & Foundry

EARLY in October an agreement was reached between the Grumman Aircraft Engineering Corporation and the Canadian Car & Foundry Co., Ltd., of Montreal, giving the Canadian company design and manufacturing rights to the Grumman FFI two-seater fighter. The ship will also be developed by Canadian Car & Foundry as an advanced trainer by installation of a 450 hp. engine. Change from trainer to fighter necessitates only new engine mounts and cowl for installation of a 750 hp. or 1,000 hp. engine—a job that can be done at any maintenance base. No structural changes are involved. Top speed as a trainer is 195 mph. With a 750 hp. Cyclone, the top is 231 mph. with full military load.

Late in December, Lieut. Howard F. Klein, the company's chief pilot and technical adviser, will take one of the ships, equipped as a two seated fighter, on a three months' sales tour of Central and South America. The tour will start from Brownsville, Tex., and then work down the Central American peninsula and the west coast of South America, then across to Buenos Aires and Montevideo. From there the route will go north to Rio de Janeiro.

Canadian Car & Foundry, established 35 years ago, is headed by Wilson W. Butler, a native of Danville, O., and former vice-president of the American Car & Foundry Co. In charge of aircraft manufacturing operations will be Vice-president L. A. Peto. The plant has a capacity of fifteen planes a week.

Navy Opens Bids

For patrols, scouting bombers; Hall gets Coast Guard order

THE Navy Bureau of Supplies and Accounts took two more steps in the Naval Aircraft procurement program last month: On Oct. 3, bids were opened for the construction of 66 flying boat patrol planes (VPB). Those bidding were Consolidated, $6,374,073; Martin, $7,106,120; and Douglas, $8,540,077. Bids for the construction of scouting bombers (VSB) were opened Oct. 16. Only bidder was Chance Vought Division of United Aircraft Corp., which bid $590,484 for 25, or $906,760 for 40. The planes will be assigned to the Naval Reserve Aviation Bases and to the fleet.

Oct. 14 the Treasury announced that an order for six Coast Guard flying boats had been awarded to the Hall Aluminum Aircraft Company, of Bristol, Pa. The boats are biplanes, and will cost $709,852. They will be used for scouting and rescue work.

Swede to Ireland

Bjorkvall lands in sea in attempted N. Y.-Stockholm flight

LATEST lone flyer to chance the north Atlantic fogs in the quest for glory was Kurt Bjorkvall, a young Swedish commercial pilot who wanted to fly to Stockholm. The flight was originally scheduled for Bjorkvall and a companion, the Baroness Eva von Blixen-Finecke. But on Oct. 6, after weeks of delay, Bjorkvall took off from Floyd Bennett Field, Brooklyn, leaving the Baroness fuming on the ground.

Engine trouble brought him down when nearly within sight of the Irish coast. The French trawler Imbrin picked him up uninjured, and landed him at Valentia. His plane was abandoned at sea.

The solo England-Australia and England-New Zealand records were again broken last month—by a woman. Jean Batten, New Zealand girl flyer who last year made a solo westward crossing of the South Atlantic, took off from Lympne Airport, England, on Oct. 5. She landed at Port Darwin, Australia, 5 days, 21 hours, three minutes later. From there she flew to Sidney, which was to be the starting point of an 1,100 mile flight across the Tasman Sea to Auckland, New Zealand. She made the trip in ten hours and a half, flying in spite of the Australian Federal Aviation Board's objections to crossings in single-engined ships. Her time from England was 11 days, 57 minutes.

Financial

Profits for Douglas, Lockheed, Beech; American Airlines loses

A NET PROFIT of $227,644 for the nine months ended Aug. 31 was reported by Douglas Aircraft Co. This is equal to 50 cents a share. It compares with a $1,082,746 profit for the first nine months of 1935.

Lockheed profits for the first six months of 1936 came to $40,213, against a $152,934 profit for the same period in 1935.

For the period from Jan. 1 to Sept. 16, at which time it was succeeded by Beech Aircraft Corporation, the Beech Aircraft Co. reported a net income of $11,096. The full year of 1935 showed a net of $7,958.

A net loss of $438,552 for the six months period ended June 30 has been reported by American Airlines.

GRUMMANS FOR EXPORT
will be manufactured in this plant of the Canadian Car & Foundry Company, at Montreal, Canada. Capacity is fifteen planes a day.

Striking Power—DEFENSIVE POWER
BOTH INCREASED
Today's Martin Bombers stand out in vivid contrast—even with those of a year or two ago. Increased reliability, increased striking power, speeds up to 240 miles per hour and service ceilings up to 29,000 feet—these tell only part of the story. Equally important improvements have been made in facilities for communication, for navigation, and for the Bomber's self-defense. Powered by the new G-Series Wright Cyclone Engines, these newest Martin Bombers (Type B-10-B, Model 139-W) are available for early delivery.
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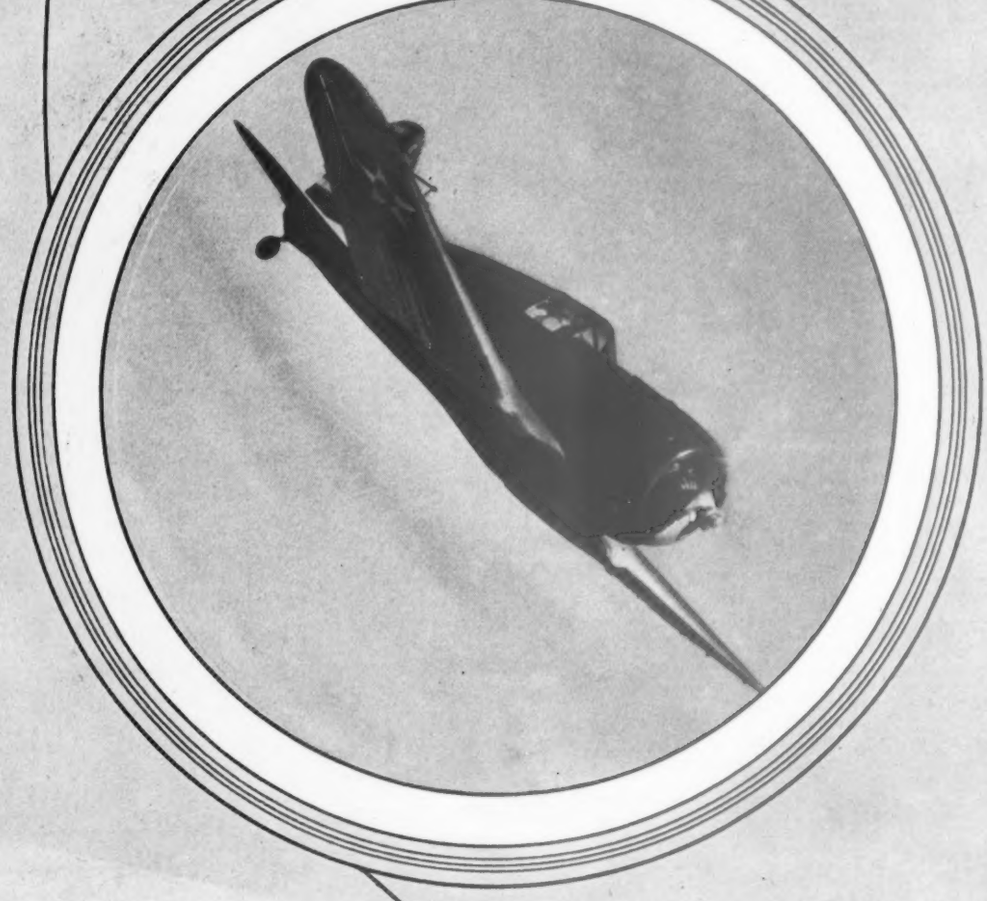

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DIVISION OF UNITED AIRCRAFT CORPORATION

Schools, Services, and Airports

A state-by-state tour of the flying fields

• ALABAMA—Oak Airport, south of FOLEY, is to be improved by the installation of lighting facilities and an administration building. A two-plane hangar has already been built. . . . The WPA has allocated about $35,000 for construction of an airport at GADSDEN. Present 1,500 ft. runways will be lengthened to 2,500 ft. . . . First, second and third-place winners in the spot landing contest for the Tutwiler trophy at BIRMINGHAM Municipal Airport, were, respectively, Glenn Messer, Winfred M. Grissom, and Charles W. Johnson. The contest was sponsored by the Birmingham Aero Club.

• ARIZONA—The PHOENIX Flying Club is cooperating with the WPA on a project to oil the runways at Phoenix Sky Harbor. The Bureau of Air Commerce has approved plans for the work drawn by the city engineering department.

• ARKANSAS—Plans are under way for the city of EL DORADO to obtain a first-class airport, with the approval of an appropriation by the City Council of $2,190 with which to purchase two tracts of land. The airport committee of the Chamber of Commerce has guaranteed purchase of a third tract at $1,100. The action by the City Council is believed to have cleared the way for a WPA project on the field whereby $10,000 will be expended to complete the east-west runway and provide other improvements.

• CALIFORNIA—Carrying out a plan to enlarge the SAN FRANCISCO Municipal Airport, Mills Field, the supervisors of San Francisco have purchased an additional 110 acres from the Mills Estate at a cost of $105,000. This gives the airport a total of 1,100 acres. One new 3,000-ft. runway has been completed and two similar runways are under construction. Concrete foundations for the new administration building, to cost $140,000, have been poured and the completed structure will be ready about Dec. 15. . . . Sportsmen's Aviation Service, run by Al Lary and John Linley, has taken over Hangar No. 5 at LOS ANGELES Municipal Airport. . . . E. R. Carter has been appointed manager of the SANTA MONICA Municipal Airport in place of V. G. Smelser. . . . According to a report by Manager W. J. Putnam, activities at LONG BEACH Municipal Airport increased 58 per cent in August over July. . . . The MODESTO City Council has ratified a proposal to close 3,400 ft. of open ditch, and install a pipe drainage system at the municipal airport. Dedication of the field is scheduled for Nov. 1, when an air show will be staged.

• COLORADO—150 men have started work on the COLORADO SPRINGS Municipal Airport. A new north-south runway, 4,550 ft. long and 150 ft. wide will be constructed. It will have an oiled surface.

• CONNECTICUT—The BRIDGEPORT Flying Club has appointed Al J. Burham chief pilot, it has been announced by James Malarkey, manager of the club. The club will have its headquarers at Mollison Airport. . . . Jack Tweed, manager of the NEW HAVEN Municipal Airport, was planning an air show for Oct. 11.

• DELAWARE—The Noisy Birdmen, an organization of aviation enthusiasts and pilots, was planning the first annual Delaware air tour for early September.

• DISTRICT OF COLUMBIA—A $100,000 improvement program under way at WASHINGTON Airport will provide a 4,200 ft. paved main runway and a 3,000-ft. cross-runway. Preparations are being made for the future installation of flush type runway lights. 5,000 ft. of drainage tile has been laid. The main runway will cross Military Road on a fill, with a 250 ft. shoulder on each side to ease the grade for automobiles using the road. Shoulders for the rest of the runway will be 200 ft. wide.

• FLORIDA—A WPA project employing 150 men is under way at MIAMI Municipal Airport, putting the field in shape for the Ninth Annual All American Air Maneuvers scheduled for Dec. 10, 11, and 12. Approximately 2½ miles of paved runways are under construction. An additional 3,600 grandstand seats together with a new steel and concrete control tower for timers, press, and officials of the meet are included in the improvement program. A total of $6,000 in prize money has been set

THE DAWN PATROL

lines up preparatory to the take-off at the Spartan School of Aeronautics, Tulsa. Jess D. Green, the school's director, reports one of the best seasons in years, with general activity up to pre-depression levels.

A "bible" of practical aerodynamics

covering airplane performance and the factors that control it

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Airplane Design

Volume I

PERFORMANCE

by Edward P. Warner

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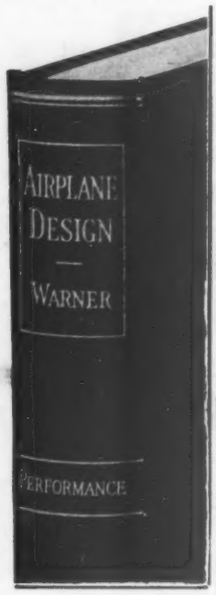

Here is the first volume of a thoroughly revised and enlarged two-volume edition of the author's earlier work, *Aerodynamics*. This book, complete in itself, covers those phenomena existing under steady conditions corresponding to steady flight of an airplane. In this field, the book presents the basic aerodynamic laws, phenomena, and collected data and the effect they have upon airplane performance. The treatment is noteworthy for emphasis upon practical applications of aerodynamics, presenting data and methods that are invaluable to airplane designers.

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Airfoil Sections
Effect of Plan Form on Airfoil Performance
Airfoil Combinations
Variable-lift Airfoil Arrangements
Effects of Surface Texture, Ground Influence, and Other Miscellaneous Airfoil Phenomena
Parasite Drag
Power-plant Characteristics and Performance
Propeller Characteristics
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Interpreting the Performance Curves
Performance by Formula and Chart

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—exhaustive study of the methods of interpreting propeller experience and calculating the type of propeller that should be used in a given problem

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PRECISION BEARINGS
BALL, ROLLER AND THRUST

aside for the racing events during the meet. . . . MIAMI will be the scene of the 1937 convention of the National Association of State Aviation Officials. . . . Presidential approval has been given to a $71,000 WPA project for the improvement of JACKSONVILLE airport. Jacksonville would contribute $28,000 as sponsor's share. Nearly $175,000 has already been spent by various government agencies in improving the field. Plans under the pending project include surfacing of runways, grading, and moving hangars further from the runways.

• GEORGIA—Thirty-six planes took part in the three-day Georgia air tour late in September. . . . Operating privileges at the SAVANNAH Municipal Airport have been leased to Harry G. Strachan, Jr., by the Savannah City Council.

• IDAHO—BOISE is considering condemnation proceedings to secure 800 acres of property for a new municipal airport. Plans call for a main runway 7,600 ft. long running northwest-southeast, an east-west runway 7,300 ft. long and a northeast-southwest runway 5,300 ft. long. They would be 850, 600 and 500 ft. wide respectively. The present municipal airport will be retained. WPA assistance will be sought for the development of the new field.

• ILLINOIS—The EAST ST. LOUIS Chamber of Commerce Aviation Committee is considering the advisability of the city's purchasing Curtiss Airport. . . . The WPA has started a project to improve JOLIET's municipal airport. Plans call for resurfacing four runways with cement-bound macadam, and the installation of two floodlights and sixteen border lights. . . . The Kewanee Flying Club has constructed a hangar on the Morgan farm, north of GALVA.

• INDIANA—RICHMOND is considering purchase of the Richmond Airport property. . . . Five new members have been initiated into the St. Joseph Valley Aviation Club, SOUTH BEND. They are Mrs. Carl Folsom, Mrs. Clifford M. Warner, Glenn W. Trickel, Russell C. Bell and Verna E. Doan. The club is planning purchase of a new plane. . . . The SOUTH BEND Pilots' Club was planning an air show at Bendix Municipal Airport, South Bend, late in September. . . . LAPORTE is considering floating a bond issue for $11,500 for purchase of a 161 acre airport. A hangar, to be constructed by the WPA at a cost of $2,057, is also planned.

• KANSAS—Twenty-seven pilots were registered for an all-Kansas air tour scheduled to leave WICHITA on Oct. 1. The itinerary, covering 1,200 miles, called for stops at twenty Kansas airports. . . . WICHITA was planning an aviation show at the municipal airport on Oct. 11, as one phase of the State's Diamond Jubilee celebration. . . . Five TOPEKA flyers, Lester Martin, Randall Sacks, Eldon Daneke, Ted Hahn and Loren Fenton have formed the Aeronca Flying Club. All except Martin hold private pilot licenses, Martin having recently attained his limited commercial license.

• KENTUCKY—According to an announcement by Albert H. Near, manager of Bowman Field, LOUISVILLE, the $50,000 WPA administration building will be completed about Dec. 1. $325,000 is being sought from the WPA for construction of concrete runways. . . . The six members of the LOUISVILLE and JEFFERSON COUNTY Air Board have been reappointed for four year terms. They are Addison W. Lee, chairman, Louis Seelbach, Albert M. Woody, W. S. Kammerer, David Fairleigh, Jr., and L. S. Vance.

• MAINE—Wesley A. Marden, basing at the WATERVILLE Airport, has been made distributor for Taylor Cubs in Maine . . . . The BANGOR City Council has passed an ordnance providing for the purchase of an 8-acre tract of land 2 miles west of the Bangor airport, upon which will be located a radio beacon . . . . Construction of a WPA hangar at the LEWISTON-AUBURN airport was scheduled to start late in September . . . . The PORTLAND Flying Service, Inc., owned by F. Gilbert Pond and H. F. TROXEL, has signed a five year lease on the land now occupied by its hangars at the Portland city airport. Due to increased business the service is planning to purchase new planes . . . . An $88,000 WPA allotment is providing hard-surfaced runways at the PORTLAND Airport. The work is scheduled for completion late in October.

• MASSACHUSETTS — The WESTFIELD City Council has passed an ordnance creating a board of three officials for the management of Barnes Airport. This is a course of action suggested by the Mayor after the city acquired $89,200 from the WPA for extensive improvements . . . . An eight-plane squadron bearing WPA officials and civic leaders toured the State late in September inspecting WPA airport projects.

• MICHIGAN—A night shift of WPA workers is in operation on BATTLE CREEK's $33,000 runway surfacing project. Grading work was scheduled for completion by late September . . . . The WPA will construct a 2,000x50 ft. asphalt landing strip on the runway at SAGINAW Airport. Turning circles 100 ft. in diameter will be constructed at each end. Also included in the plan is a 400-ft. taxi strip . . . . The BENTON HARBOR City Commission is considering establishment of an aviation department to operate Benton Harbor Airport. Bert Briney, acting manager of the field, has been proposed for appointment as manager . . . . A two-day air show, featuring Bob O'Dell and Art Davis, was held at Bishop Airport, FLINT, late in September. About 10,000 spectators attended . . . . Michigan department of conservation has purchased a radio-equipped plane to aid in combating forest fires . . . . The WPA project for construction of runways at the KALAMAZOO Municipal Airport was completed early in September, and American Airlines daily service resumed.

• MINNESOTA — Roy H. OLSON, DULUTH, has been appointed a member of the Aviation Committee of the United States Junior Chamber of Commerce . . . . An air show and model contest were planned for the dedication of CLOQUET Municipal Airport Sept. 27.

• MISSISSIPPI — Dedication ceremonies were scheduled for Oct. 13 at the new Eddie Stinson Airport, ABERDEEN. Also scheduled for dedication was TUPELO's new $50,000 municipal field. The port covers about 130 acres, and plans call for four runways, floodlights and hangars.

• MISSOURI — Authority to construct a hangar at the POPLAR BLUFF Municipal Airport has been given by the WPA. The hangar will be built of native stone and will have room for eight ships. It will have office room and a mechanical department. Cost will be $19,905 . . . . A proposed $1,000,000 bond issue for improvements at KANSAS CITY Airport will come up for a vote Nov. 3. If the issue is approved, construction will begin immediately on surfacing and reinforcing the runways, construction of taxi strips, improving lighting facilities and providing adequate fire protection. . . . The K-12 flying club, basing at SPRINGFIELD Airport, has purchased a Whirlwind-powered Commandaire. The fee for club membership is $50, and flying time in the new ship costs members $3 an hour. Club instructors are Karl Lipscomb and R. C. Clayton.

• MONTANA—Work was started late in September on a new hangar at the BILLINGS Municipal Airport, for which a $50,000 bond issue was voted last spring. The WPA has granted an additional $40,000 for construction of the 128x130 ft. building. When completed the hangar will be leased to Northwest Airlines.

• NEBRASKA—Service facilities of Western Air Service, SCOTTSBLUFF, have been improved by the employment of an additional mechanic . . .

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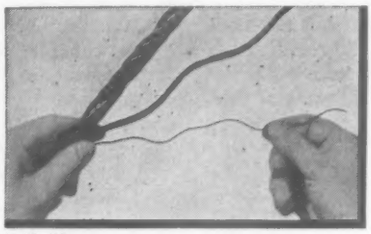

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Cost to the city of OMAHA for the Municipal Airport has been reduced in the last few years from $15,000 to $5,000 per year, and the finance commissioner expects the field to be on a self-sustaining basis within two years.

• NEVADA—An agreement has been signed between WASHOE COUNTY and United Air Lines, whereby United will deed to the county Hubbard Field, RENO. The county will then purchase an additional 250 acres, paying up to $18,000 of the cost. Anything over $18,000 will be paid by United Air Lines. The line will have the use of the field and will maintain it for 25 years. The WPA has authorized expenditure of $490,000 for improvement work, of which $200,000 is now available.

• NEW HAMPSHIRE—The finance committee of the CONCORD Board of Aldermen has voted to recommend to the full board that it approve $7,500 as the purchase price of that part of the Concord Airport now owned by the Concord Airport Corporation. . . . Winnipesaukee Air Service was scheduled to close its fourteenth season at Weir late in September. The season's record showed 2,000 flights carrying 5,000 passengers. Through the season, the Beechcraft covered 22,400 miles, the Waco 14,000 miles, and the Stinson 14,400 miles. The service is run by Thomas E. P. Rice.

• NEW JERSEY—A meeting of the New Jersey State Aviation Association was held Oct. 6 at the Robert Treat Hotel, NEWARK. Grove Webster was chairman. Principal speaker was Gill Robb Wilson, director of aviation for the State of New Jersey, who traced the history of the New Jersey State Aviation Commission. . . . A crowd of 10,000 witnessed an air show in which 36 planes participated at Mercer Airport, TRENTON, late in September. . . . The WPA has given final approval to the $3,292,000 project for construction of a 1,045x200 ft. hangar at NEWARK Airport. $700,000 of the total will be supplied by the city. The hangar is part of a $4,000,000 improvement project at the field which calls also for new runways and a new drainage system. . . . An air show was scheduled for late September at Murchio Field, Paterson.

• NEW YORK—The BUFFALO Common Council late in September approved plans for the modernization of the Buffalo Municipal Airport as a WPA project. Cost will be $1,304,434, of which the city's share as sponsor is about $339,000. It is planned to work three shifts of 1,256 men each, using floodlights so that the work can be carried on at night. Improvements call for leveling of the hill that runs parallel to the east-west runway, hard surfacing present runways, constructing a new administration building and two new hangars, which will be 140x180 ft. The new administration building will provide for a restaurant, customs and immigration offices, ticket office, and hotel facilities. Sept. 25 the airport celebrated its tenth anniversary. In 1926 daily departures and arrivals averaged one a day. In 1936 seventeen scheduled transports land and take off daily. . . . Joseph Fitzgerald, manager of ALBANY Airport, has reported that through August, 4,379 planes have landed at the field. . . . The WPA has approved an improvement project for DANSVILLE Municipal Airport. . . . $90,000 has been allocated by the WPA for construction of an airport at EAST HAMPTON. Three runways are called for. . . . BINGHAMTON and ENDICOTT have voted to sponsor a joint airport at WEST ENDICOTT. The two cities will share equally the $17,235 purchase price of the field and a sponsor's contribution of $25,292 to secure a WPA allocation of $118,000. . . . FORT PLAIN is considering establishment of a seaplane base on the Mohawk River. . . . New York State Airport Managers Association held its quarterly meeting in ROCHESTER Sept. 15-16. The sessions were under the direction of Howard Shafer, manager of Rochester Municipal Airport.

• NORTH CAROLINA—DURHAM is considering methods of making acceptable to the WPA an application for assistance in construction of an airport. Cost of material under the present application is too high. . . . Work has started on the project to move the hangars at Miller Municipal Airport, WINSTON-SALEM. . . . $40,000 has been allotted by the WPA for paving the runway at SALISBURY Airport. It will be 2,700 ft. long and 100 ft. wide.

• OHIO—Norman Peters, in a Stinson cabin, won the Sportsman Pilot Cruise of 1936 sponsored by The Toledo *Blade*. It was the third annual running of the cruise. Second place in the 1936 cruise went to Ted Paryski, who was the winner last year. He flew a Fairchild. Third was Howard Raitz, flying a Rearwin; fourth, Chet Fenton, in a Monocoupe. . . . A vote of stockholders of the Transcontinental Airport Co., TOLEDO, was scheduled for early October to determine whether the city's offer of $65,000 for the purchase of the field would be accepted. . . . A two-day air show was held at Lost Nation Airport, WILLOUGHBY, early in September.

• OKLAHOMA—An air show will dedicate OKLAHOMA CITY's new $80,000 Army hangar at the Oklahoma City Municipal Airport on Nov. 1, Moss Patterson, president of the Oklahoma City Aviation Club, has announced. . . . The MUSKOGEE City Council is asking bids on issuance of bonds to provide improvements at Hatbox Airport.

• OREGON—A crowd of 10,000 witnessed the air show featured at the dedication of the PORT OF ASTORIA Municipal Airport. Bessie Gale Halladay, of PORTLAND, won a Portland-to-Astoria handicap race. Loren Corder came in second.

• PENNSYLVANIA—A new hangar and administration building will be built at WARREN Airport. The improvement will be part of a $175,000 program being carried out by the WPA. The hangar itself will be 60x80 ft., and attached to it will be an office, waiting room and living quarters for the airport manager. . . . An air show, attended by 5,000, was held at ERIE Airport, KEARSARGE, late in September. Featured performers were Harrison Doyle, Bob Meyer, and Neil McCray. . . . WILLIAMSPORT Airport, MONTOURSVILLE, has a new Lycoming-powered Stinson ambulance plane. Construction of two new macadam-surfaced runways at the field was scheduled to start early in October as a WPA project. Plans called for one runway, 3,450 ft. long, running northwest-southeast, and another 2,170 ft. long running east-west. . . . An aviation commission, headed by Alfred L. Wolf, has been set up by the mayor of PHILADELPHIA. Other members are W. Laurence LePage, Laurence P. Sharpless, and Major Victor Dallin. . . . Improvement work at WILKES-BARRE airport, carried out by the WPA at a cost of $175,000, was scheduled for completion late in October.

• SOUTH CAROLINA—The Carolina Aero Club, made up of aviators from South Carolina, North Carolina and Georgia, was scheduled to hold its October meeting in CHARLESTON on the seventeenth and eighteenth. . . . The WPA has allocated funds for a $23,000 airport project at ORANGEBURG. Plans call for a 60x40-ft. steel hangar, and two runways, 2,000 and 3,000 ft. long.

• SOUTH DAKOTA—An air show was scheduled at BROOKINGS early in October. The performers included Clyde Ice and Fred Hight.

• TENNESSEE—The WPA project at NASHVILLE Municipal Airport will be well enough along for a formal opening on Nov. 1, when grading will be completed and one hangar finished. Total excavation amounts to 1,300,000 cu.yd. . . . Paving of the northwest-southeast runway at Lovell Field, CHATTANOOGA, was scheduled to start early in September. It will be 3,600 ft. long and 150 ft. wide.

• TEXAS—$82,858 has been allocated by the WPA for improvements at Love Field, DALLAS. . . . Stinson Field, SAN ANTONIO's new $150,000 commercial airport, was to be formally dedicated late in September with an air

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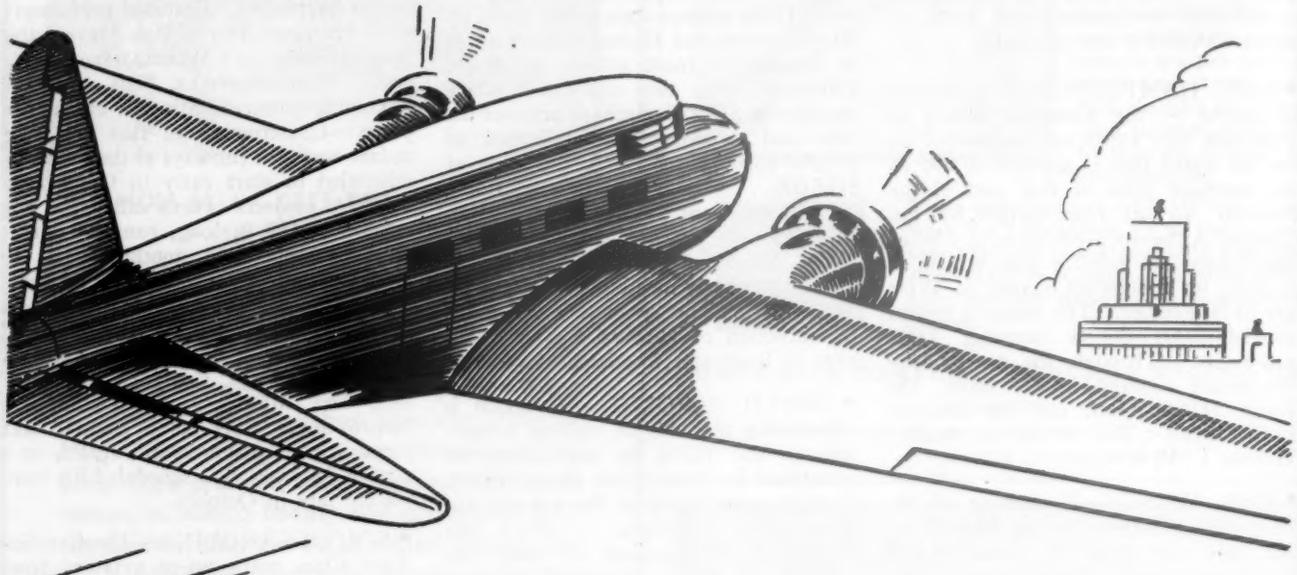

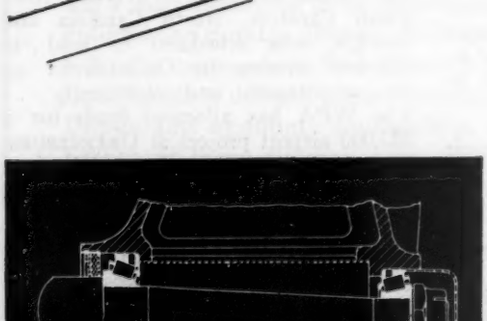

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show. A four-day program was planned. . . . The AMARILLO Chamber of Commerce airport committee has decided to withdraw its proposal that English Field be obtained for the city for development of the municipal airport, and has transferred its efforts to the old municipal airport. . . . Les Mauldin has purchased the hangar and other physical assets at San Benito field, and will move them to a new $25,000 airport, 6 miles from BROWNSVILLE. The hangar will be enlarged from 60x80 ft. to 120x80 ft. . . . EL PASO is considering establishment of a $500,000 Union Air Terminal on the site of the American Airlines airport. WPA assistance will be sought.

• UTAH—The WPA has allotted $1,000,000 for an airport improvement program at SALT LAKE CITY. Plans call for resurfacing of three runways with concrete and asphalt, an addition to the administration building, an apron front for the hangars and a field drainage system. City and county officials were planning an aviation week in celebration of the project. Before the money can be obtained, the city must put up $240,000.

• VERMONT — The BURLINGTON Champlain Air Taxi Service, which operates two Lycoming Stinsons, has majored its ships and motors in anticipation of a busy winter season. . . . Howard Dutton, manager of the MONTPELIER-BARRE Airport, has just purchased a new Taylor Cub from Wesley Marden of Waterville, Me. . . . The RUTLAND board of aldermen has favored leasing a small plot at the municipal airport to L. E. Marden, manager of the port, for installation of gasoline servicing equipment. . . . WPA has allocated $19,000 for improvement work at the FAIR HAVEN Airport.

• VIRGINIA—NORFOLK is considering establishment of a municipal airport with WPA funds. . . . STAUNTON airport was opened with a show early in September. The City Council is considering erection of a hangar. . . . The WPA has allocated $25,189 for extending the runway and installing the lighting system at Byrd Airport, RICHMOND.

• WASHINGTON — SNOHOMISH COUNTY Commissioners are planning acquisition of 640 acres of land for construction of a new airport. Present plans call for one runway, to cost $240,000. . . . SEATTLE councilmen are considering establishment of a seaplane base north of Madison Park on Lake Washington. . . . Tacoma Flying Service, Inc., basing at Mueller-Harkins Airport, TACOMA, is installing short-wave radio equipment at the field.

• WEST VIRGINIA—The first annual MARTINSBURG Air Races, sponsored by George DeGrange, was held at Van Metre field, Martinsburg, early in September. . . . Runway surfacing was scheduled to begin at Harrison County Airport, CLARKSBURG, in September.

Schools

• Using the 8-ton tri-motored Boeing 80-A transport as a flying classroom, students of the BOEING SCHOOL OF AERONAUTICS, Oakland (Calif.) taking the transport pilot's course, recently made a flight from Oakland to Chicago and return over United Air Lines' mid-continent route. The superintendent of flight instruction, George I. Myers, was in charge of the tour, which was to acquaint the students with regular airline operation practices. In the school's radio department, greater stress is being laid on the teaching of radio codes, because of its increasing importance in inter-continental and transoceanic service. The instructor is Lee Holdakowski, senior operator at United Air Lines' Oakland station.

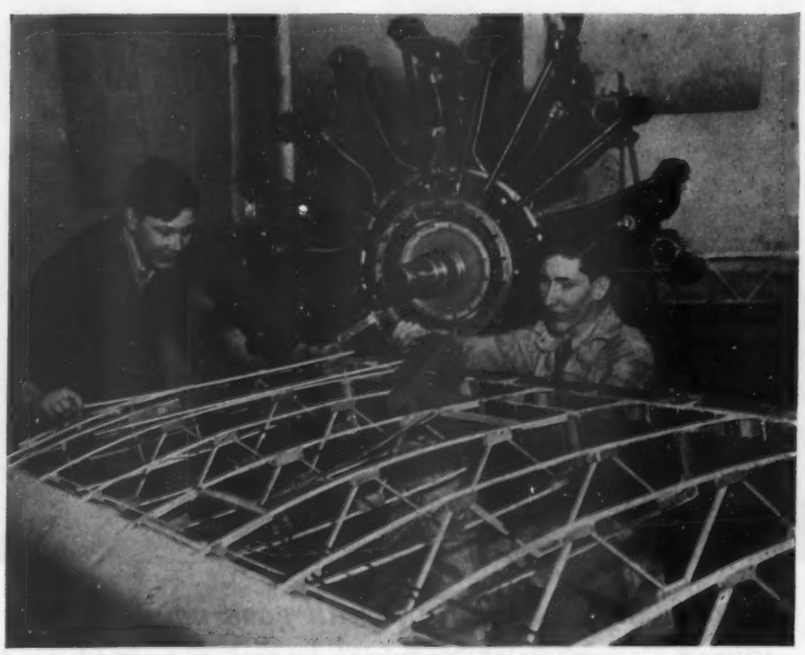
• PARKS AIR COLLEGE, East St. Louis (Ill.) reported 98 students, representing 31 states, enrolled for the fall term. This brought total enrollment to 262.

• The SPARTAN SCHOOL OF AERONAUTICS, Tulsa (Okla.), reports that recent enrollments are far ahead of the last few years and most of the new students are enrolling in the longer and more complete transport courses. At the same time graduates are being placed in the Spartan factory as soon as they finish their training. In the past few weeks nine have gone to work there on the all-metal Spartan Executive models.

• A number of students of the WARREN SCHOOL OF AERONAUTICS, Los Angeles (Cal.) were chosen for field service at National Air Races in Los Angeles.

• The WEEMS SYSTEM OF NAVIGATION has arranged to give a series of lectures on celestial navigation methods at the Hayden Planetarium, New York, on Tuesday nights through the winter.

• Chief Instructor at the North Texas Agricultural College aviation course is Fred L. Snavely. The school has fourteen radial engines and five liquid-cooled engines for instruction work. At present students are overhauling a J-5 Stearman. . . . Andrew H. Bleau has been appointed flying instructor for the NEW LONDON AVIATION CLUB, New London (Conn.). A Taylor Cub is used for instruction. . . . A WPA aviation ground school was opened at TAMPA (Fla.) late in September. . . . The faculty of the UNIVERSITY OF FLORIDA's aviation ground school at Miami consists of David E. Long, William C. Lazarus, E. L. Kerlin and H. J. Chidd. . . . The JENNINGS BROS., who operate a flying school at the Worcester-Grafton airport, Worcester (Mass.) are planning installation of ski equipment on their flying equipment for winter service. A Taylor Cub, a Fleet, and a Stinson are used in instruction work. . . . HOWARD HARTMAN, flying instructor at the Nashua (N. H.) Municipal Airport, has purchased a new Taylor Cub for flying instruction. In addition to the Cub he has a four-passenger Stinson. . . . Night classes at the ROBERTSON AVIATION SCHOOL, St. Louis (Mo.) opened Sept. 14.



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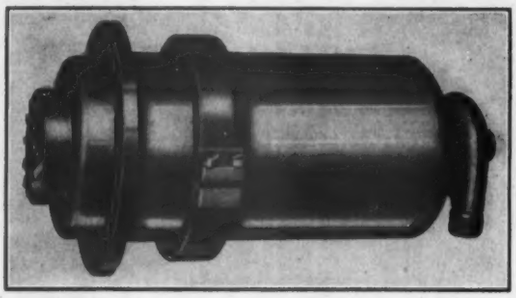

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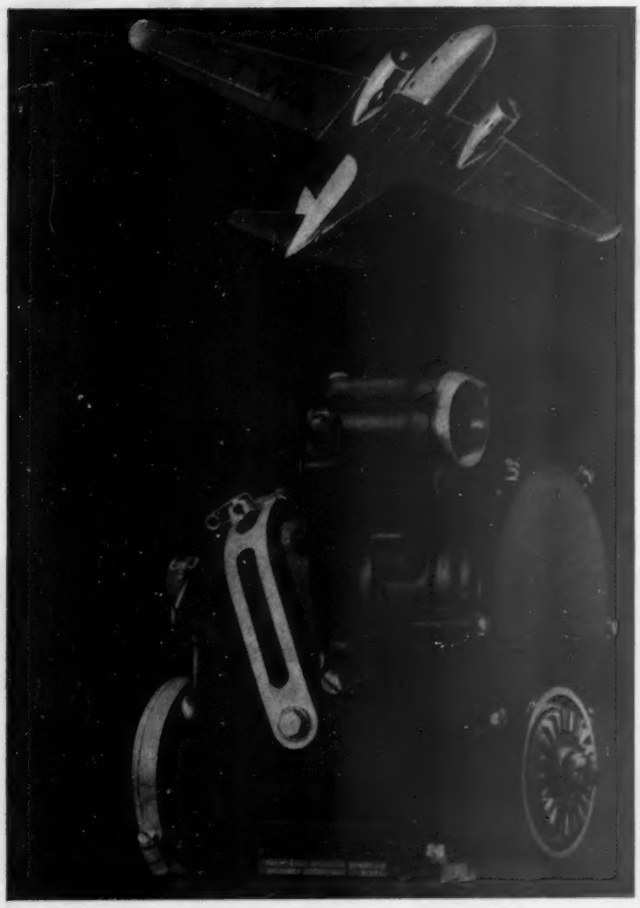

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Aviation People

Who's who and what they are doing

• The Board of Directors of United Aircraft Exports elected as president THOMAS F. HAMILTON, a director of United Aircraft Corporation and for many years associated with the export activities of the company. He succeeds C. W. DEEDS, a vice-president and director of United Aircraft Corporation, who will devote his full time to the management of the Pratt & Whitney Aircraft Division, a post to which he was appointed last year. J. REED MILLER, former treasurer, was elected vice-president, and JAMES J. O'SHEA takes his place as treasurer. Alexis R. Stocker, who was elected vice-president of the Exports corporation last year, continues in that capacity.

Mr. Hamilton, a member of the Early Birds, formed the Hamilton Aero Manufacturing Company in Seattle in 1909, which delivered thousands of propellers to the United States government and its allies during the war. Continuing his propeller production, he developed the first all-metal plane to be licensed in America in 1921. In 1929 the Hamilton Standard Propeller Corporation was formed, with Mr. Hamilton serving as chairman of the board of directors and a director of United Aircraft. Later he became president of United Airports of California, at that time a United Aircraft subsidiary, then European representative for United Aircraft Exports with headquarters abroad, handling foreign sales of Hamilton Standard propellers, Pratt & Whitney engines, and Vought and Sikorsky planes.

Thomas F. Hamilton

Charles W. Deeds

J. Reed Miller

Frederick R. Neely

• Goodwill Ambassador FREDERICK R. NEELY, chief of the information section of the Bureau of Air Commerce, has completed a 15,000 mile flight through the West Indies, South America, Canal Zone, Central America, Mexico, and return. On behalf of the government he called on officials of those countries which had participated in the International Aviation Congress held in Washington last fall, expressing appreciation of their cooperation.

• The Netherlands West Indies branch of K.L.M. has as new manager COLONEL H. STEENSMA, formerly with K.L.M. in Holland. Colonel Steensma is quartered at Willemstad, Curacao.

• The passenger comfort along more than 3,000 miles of Eastern Air Lines routes rests on the shoulders of WALTER L. AVERY, newly made superintendent of passenger service, at present engaged in a survey of the network. For the past three years he has been with Transcontinental & Western Air, serving as co-pilot, flight dispatcher at Newark and Kansas City, and latterly as superintendent of passenger service.

• The scene shifts for CLIFTON W. POWER, who will direct the expanded facilities of Eastern Air Lines in Indianapolis as district traffic representative; for MARVIN HORSTMAN, newly placed as co-pilot on Eastern Air Lines Newark to Miami run; for GENE SPEAR who has been made operator of the new traffic system being installed at Boeing Field; for COL. CLARENCE L. TINKER who has been transferred to the east and who will be succeeded as Commandant of the 7th Bombardment Group at Hamilton Field, Cal., by COL. DAVENPORT JOHNSON, both having been promoted from the rank of Lieut. Colonel; for LIEUT. COL. LEO A. WALTON, appointed First Wing executive and aide-de-camp to BRIG. GEN. DELOS C. EMMONS, commander of the First Wing G.H.Q. Air Force at March Field.

• Gangplank Treaders: Westward: The French Ministry of Technical Education has sent ROBERT BONAME to observe American airline operations and technical work, with the expectation of applying his findings to its course of study. During his two months' visit he will drop in at Langley Field, M.I.T., Caltech, and at the Los Angeles meeting of the S.A.E. Mr. Boname was connected with General Aviation in 1932, on his return to France was in charge of aerodynamic research for Liore et Olivier. . . . GEORGES GOLDMAN, engineer with Air Equipment of France, subsidiary of Bendix Aviation, came to acquaint himself with the parent organization. . . . MR. AND MRS. W. E. DAVIS, who operate Cinque Ports Flying Club at Lympne, England, dropped over for an 8-day visit to flying clubs, schools, and airports in the vicinity of New York. . . . The "Hindenburg" brought ANDREAS F. BRONSING, managing director of Netherlands Steamship Company and THEODORE A. W. RUYS, managing director of Rotterdam Lloyd Steamship Company, as representatives of a Dutch airship syndicate. . . . Distinguished passenger was DR. HUGO ECKENER, here to discuss future plans of the airship with the Department of Commerce. The maestro's plan is that the United States either build, or have built, a sister dirigible to put the operation on a profit-making basis. . . . also MAX KOCH of the German Air Ministry and CARL CHRISTIANSEN and FRIEDRICH W. THIEMANN of the German Zeppelin Company, the former being the company's Polish representative.

Eastward: Lakehurst presented a miniature aeronautical convention of international flavor at the Sept. 30 sailing of the "Hindenburg." Farewell-wavers included DR. CLARK B. MILLIKAN of Caltech and ARTHUR NUTT of Wright Aeronautical Company, enroute to read their papers before the meeting of the Lilienthal Gesellschaft fur Luftfahrt Forschung in Berlin. . . . MAJOR LESTER D. GARDNER, secretary of the Institute of the Aeronautical Sciences, bound for the same meeting, to continue by plane to Moscow, then on to visit aeronautical laboratories in Rome,

Paris, London. . . . Dr. Henrich Koppenberg, general director of Junkers Flugzeug & Motorenwerke of Germany. . . . Dr. Otto J. Merkel whose intended return on the previous trip had been postponed. . . . Miss Antonia Strassmann, connected with Bendix Aviation. . . . Dr. George W. Lewis, chairman of the N.A.C.A., left on the Sept. 21 flight of the airship to make an aviation survey abroad. . . . On its last flight on Oct. 9, Harry A. Bruno, dircctor of public relations for the German Zeppelin Company in the United States, and Mrs. Bruno, were aboard. . . . also W. D. Kennedy of Wright Aeronautical Corporation. . . . Major Alford J. Williams, manager of the aviation department of Gulf Oil, set sail to unofficially visit friends in Europe, to further "closer understanding between European and American aviation."

• In reporting the visit of Mr. F. R. Banks of London to this country in our August issue, we erroneously stated that he was affiliated with Shell Oil Company. Mr. Banks is technical representative of Ethyl Export Corporation, and has now returned to his headquarters in London.

• After three years as engineer with the Waco Aircraft Company, R. H. Draut has now become associated with Glenn L. Martin Company.

• Bendix Trophy winner Louise Thaden has resigned from her air-marking job with the Bureau of Air Commerce, to work in a promotional capacity for Beech Aircraft Company. It was a Beechcraft that flew Mrs. Thaden to victory. In a similar craft she will visit Australia and possibly South America. Major task is to sell members of her sex on the idea of flying. Blanch Noyes, recently added to the air marking staff of the Bureau of Air Commerce, will take over Mrs. Thaden's duties.

• Chief Engineer D. E. Anderson of Bohn Aluminum & Brass Corporation calls attention to the fact that his work with Arrow Aircraft Corporation, as reported in our September issue, does not sever his connection with the Bohn Company, his consultation job for the Arrow people being concerned with Bohnalite.

• William F. Wise and R. B. Criddle have been appointed respectively president and secretary-treasurer of Republic Products Corp. of Detroit. Both had previously been connected with Ex-Cell-O Aircraft & Tool Corporation, Mr. Wise as general sales manager and Mr. Criddle as sales manager of the machinery division.

Side Slips

By Robert R. Osborn

WHILE on the "pre-view" flight for reporters before the official opening of passenger service on Pan American's Pacific service, C. B. Allen of the New York *Herald Tribune* wrote in his wireless dispatch:

"The most exciting pastime of the over-night air journey to Hawaii was watching the brilliant hues of the flaming sunset fading into the star-studded purple mantle of the night, and waking hours later to see the waning moon rising upon the horizon behind the Clipper, lighting the cloud canyons below the speeding ship and throwing their pitch black mile-and-a-half depths into sharp relief."

Knowing "C.B." for the case hardened reporter he is we can imagine him exclaiming "Hot Damn" and smiling out of one corner of his mouth when that bit of poetry popped out of his typewriter.

From years of piloting in the Army Air Service and on his own, C.B. can recognize aeronautical hokum at three miles without the aid of field glasses. We have been with him a number of times when he was interviewing press agents or publicity-hungry pilots or manufacturers. On such occasions the expression on his face varies between "Oh, Yeah?" and "Hokum, Sailor!"

A recent item in the New York papers tells of an unlucky sea gull which crashed into the wing leading edge of one of the Army's Martin Bombers, making it necessary for the pilot to

abandon the flight and return to Mitchell Field.

Suggestion for the writers of hair-raising stories in the pulp magazines—spies training sea gulls to fly into U. S. airplanes in the next war.

The news in each day's paper makes us more glad that we gave up the idea of a South Sea Island, in favor of Hudson Bay, as the location for the dug-out in which we hope to spend the duration of the next war. Just today we read the announcement by the State Department's Munitions Control Board which showed that Pitcairn's Island had bought $46 worth of rifles and carbines and $8 in ammunition during September.

As we go to press three reporters are on a speed dash around the world, hoping to connect with the Pan American China Clipper leaving Manila Oct. 16th. One of them, Leo Kieran, carries a tooth brush, a change of clothing and a copy of *"Gone With The Wind,"* the last article a gift from his boss. Read-

ers who have read this book will realize why Mr. Kieran is carrying so little other baggage—weight being so important in airplane traffic. If he had tried to take along "Anthony Adverse," he would have been reduced to nothing but an extra vest.

A recent speech by Neville Chamberlain, Chancellor of the Exchequer for Great Britain, contains a very interesting statement:—

"I can imagine no more sobering thought to any ruler who might be contemplating aggression against his neighbor than the knowledge that within a few hours his action might be followed by retaliation from a force of such terrific striking power as our new air force will possess. I regard our air force, when fully developed, as the most formidable deterrent to war that could be devised, and I support its establishment with the greater conviction and enthusiasm because every one knows that it will never be used to make an unprovoked attack on any one."

Thereby changing the slogan from "Britannia Rules the Waves" to "Britannia Rules the Air Bumps."

"The Pylon Club's second annual regatta will be held at Patco Field, Norristown, tomorrow. More than a dozen planes have been entered in this 300 mile race sponsored by Tony Little. There will be considerable activity at the club all day, with the first plane starting off at noon. Another feature will be skeet shooting."—Item in Philadelphia *Ledger*.

With racing airplanes getting smaller every year we don't believe it is a very good idea to combine air racing and skeet shooting in one program.